DCP-R

User Manual

dcp-release-12.1.1

DCP-R-9D-CS

DCP-R-34D-CS

The specifications and information within this manual are subject to change without further notice. All statements, information and recommendations are believed to be accurate but are presented without warranty of any kind. Users must take full responsibility for their application of any products.

Contents

1 Introduction

1.1 General

The DCP-Series is an optical transmission platform. The DCP-R is a disaggregated 19” 1U chassis system for ROADMs. All optical components needed for one ROADM degree are integrated in the chassis. DCP-R has front-to-back airflow. The back side of the chassis has hot-pluggable redundant power supplies and a fan unit including 4 individual fans. DCP-R is available in two versions in this release:

- DCP-R-9D-CS This system is used for coherent service applications.
- DCP-R-34D-CS This system is used for coherent service applications.

1.2 DCP-R

The key features for the DCP-R series are:

- **High level of automation and openness**
  - Typically controlled through NetConf
  - Compliant with the OpenROADM API
  - Uses TransportPCE as a SDN controller
  - Automatic fibre distance measurement
  - Automatic modulation format detection
- **High level of traffic format and modulation support. Can support the following:**
  - NRZ modulated wavelength (1-10G Ethernet, 1-16G FC, CPRI 1-10, SONET, SDH, OTN etc)
  - Coherent modulated wavelengths (100G, 200G, 300G & 400G)
  - 400ZR OIF based wavelengths (400G)
- **Optimized for ring and meshed applications**
  - Up to 9-Degrees supported with DCP-R-9D-CS
  - Up to 12-Degrees supported with DCP-R-34D-CS
- **Support for Flexgrid**

Figure 1. *Front view of DCP-R-9D-CS.*

1.3 In commercial confidence

The manual is provided in commercial confidence and shall be treated as such.

1.4 Document Revision History

Revision	Date	Description of changes
8.1.1 A	2023-07-06	Updated chapter about ILA replacement with factory default Updated text about replacement of DCP-R in single degree node Added chapter about ILA installation Added section about process for upgrade of a ROADM node
8.1.1 PB1	2023-07-11	Updated the upgrade chapter with sftpuser example
8.1.3 A	2023-10-06	Updated alarm list Updated SNMP with SNMPv3 options Added chapter about commissioning of ROADMs and ILAs in managedCLI mode Added chapter with HW config of ILA Added chapter about 9D Application Added chapter about breakout box
8.1.4 A	2023-10-12	No update
8.1.5 A	2023-11-02	No update
8.1.6 A	2023-11-13	Updated front pictures
8.1.7 A	2024-01-10	SNMPv3 traps removed
9.0.1 A	2024-01-17	No update
9.0.1 PB1	2024-03-26	Updated picture for 9D ROADM
10.0.1 A	2024-07-03	Updated picture for 9D ROADM Added altitude Added DCP-R-34D-CS Removed OSC transceivers with 1490nm Added min/max character limits for node ID Updated chapter about user accounts Added support for OSC SO-SFP-L50D-C51 Added chapters about adding and removing chassis Added show alarm list Added chapter about factory default Added SW upgrade comment about waiting for DCP-R reboot to finish before upgrading the shelf controller.
10.0.2 A	2024-09-05	Added appendix with typical power levels on add/drop ports Added text about user levels admin, opertor, readonly Added chapters for RADIUS and TACACS settings for different user levels
10.1.1 A	2024-11-20	Added references to DCP-SC-28P and its User manual Updated power consumption and weight
11.0.1 A	2024-12-12	Updated with examples for user roles in RADIUS
11.0.2 A	2024-12-17	Updated alarm list
11.0.3 A	2025-01-29	Updated pictures and tables for shuffle box

11.1.1 A	2025-03-25	Added chapter with Raman Updated chapter with commisioning of VOA in managedCLI mode Updated chapter with monitoring points
11.3.1 A	2025-04-24	Added chapter about virtual ports Updated pictures for DCP-R-34D-CS
12.0.1 A	2025-06-16	No update
12.0.2 A	2025-08-08	Updated text about settings for Raman Added table with allowed actions for different users
12.1.1 A	2025-09-08	No update
12.1.1 B	2025-12-18	Updated text about flexgrid Updated chapter about replacement

2 Functional description

2.1 DCP-R-9D-CS

The DCP-R-9D-CS product is a “ROADM on a blade” solution with everything needed for one ROADM degree in a 1RU chassis. This unit is optimized for transport of coherent services that will not require tunable dispersion compensation, but it can also be used for other services if external dispersion compensation is used.
DCP-R-9D-CS can be used in ROADM configurations up to 9 degrees.

This chassis has front to back air flow and can use AC or DC power. The power and FAN units are redundant and can be replaced. They are accessed from the rear side of the chassis.

Figure 2. *Chassis front view of DCP-R-9D-CS*

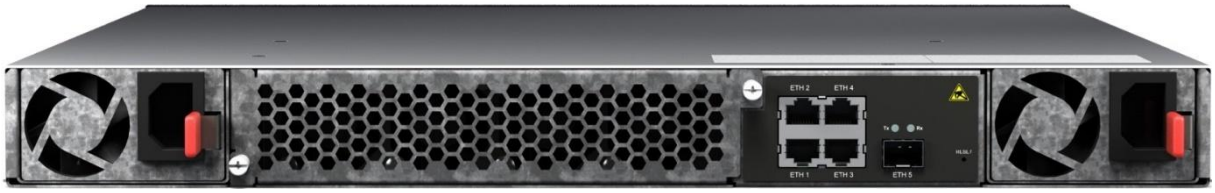


Figure 3. *Chassis rear view of DCP-R-9D-CS*

The DCP-R-9D-CS contains a twin 1x9 Flexgrid WSS, OCM, booster and pre-amplifier, a 40ch mux/demux with 75GHz BW, a VOA for the line side and OSC filters. The OSC channel uses a pluggable SFP to support different distances. The OSC port can also use special SFPs for combined OSC+OTDR functionality.

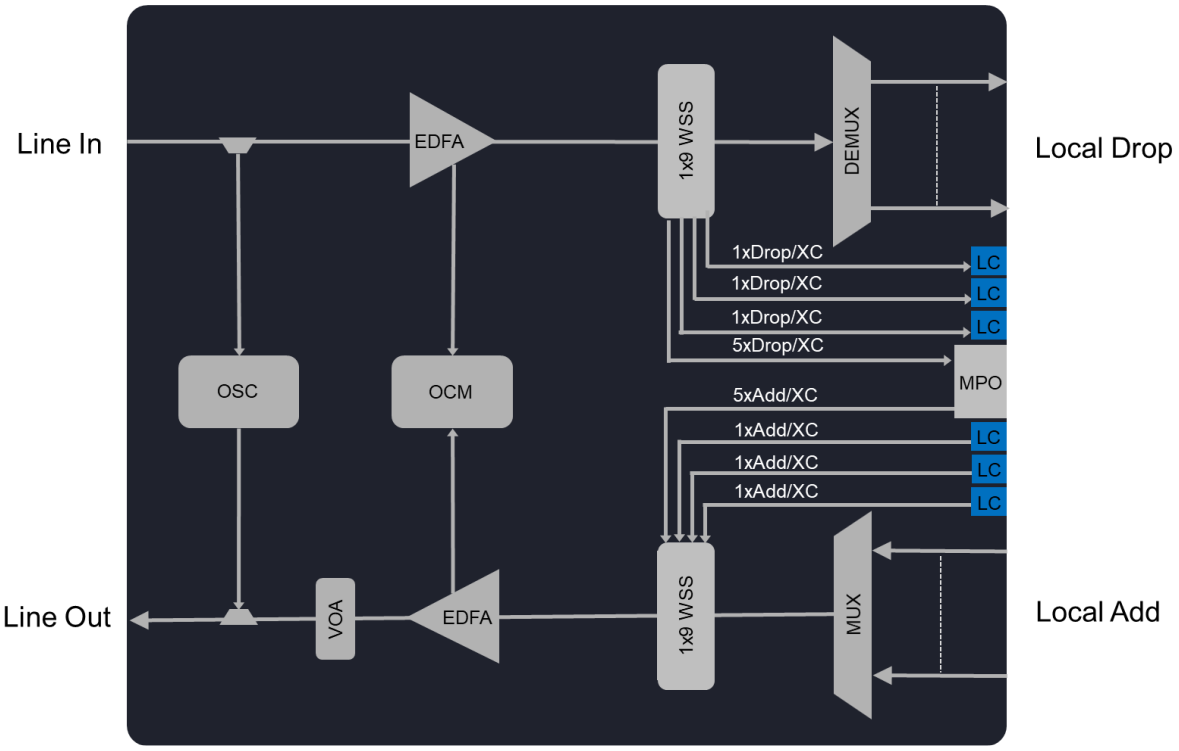


Figure 4. *Functional diagram of DCP-R-9D-CS*

2.1.1 2 Degree ROADM application

A 2D ROADM node can be created by using two DCP-R-9D-CS units and interconnect them with a pair of patch cords between the WSS ports for express. See picture below.

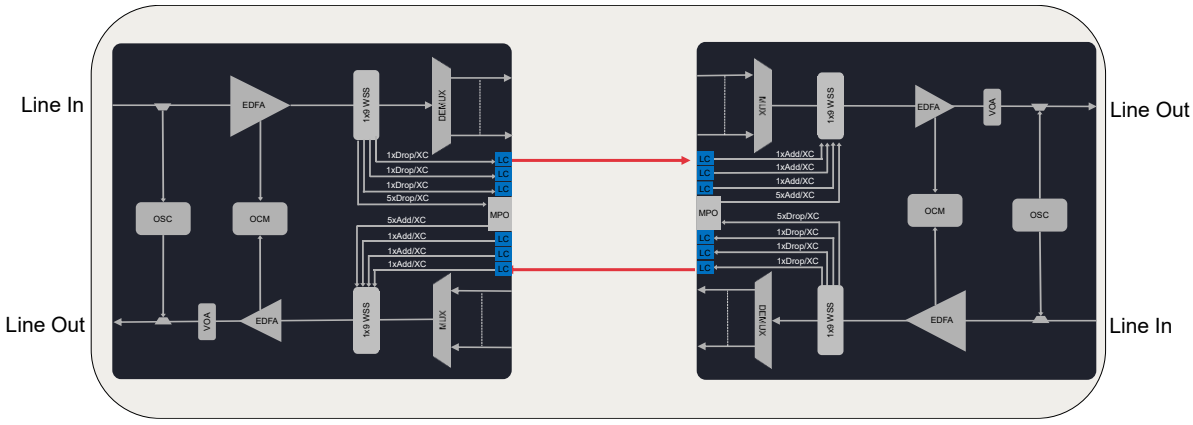


Figure 5. *Functional diagram of a 2D ROADM node with two DCP-R-9D-CS*

The Dual Flexgrid WSS in the ROADM has 9 ports and in a 2D ROADM node only two ports are used, one for the integrated 40ch mux/demux and one for the express connection. It means that we have 7 WSS ports available. Those could be used to add

additional filters to get additional channels or to add components for colorless or directionless applications.

All the components support flexgrid. The integrated mux/demux has 40 low loss ports that are optimized to support coherent signals with up to 70Gbaud, e.g. 400G 16QAM.

2.1.2 4 Degree ROADM application

The 4 degree ROADM nodes will be built with same components as in the 2 degree ROADM nodes, i.e. DCP-R-9D-CS. For 4 directions it will be 4 DCP-R-9D-CS that will be directly interconnected via the WSS ports.

Interconnection between degrees can be done via the 3 LC connectors or via the 5 connections in the MPO connector. If the MPO connector is used for interconnection it is also recommended to have a shuffle box to avoid complicated connections via breakout cables. The picture below shows a typical ROADM node with 4 degrees that are interconnected via a shuffle box.

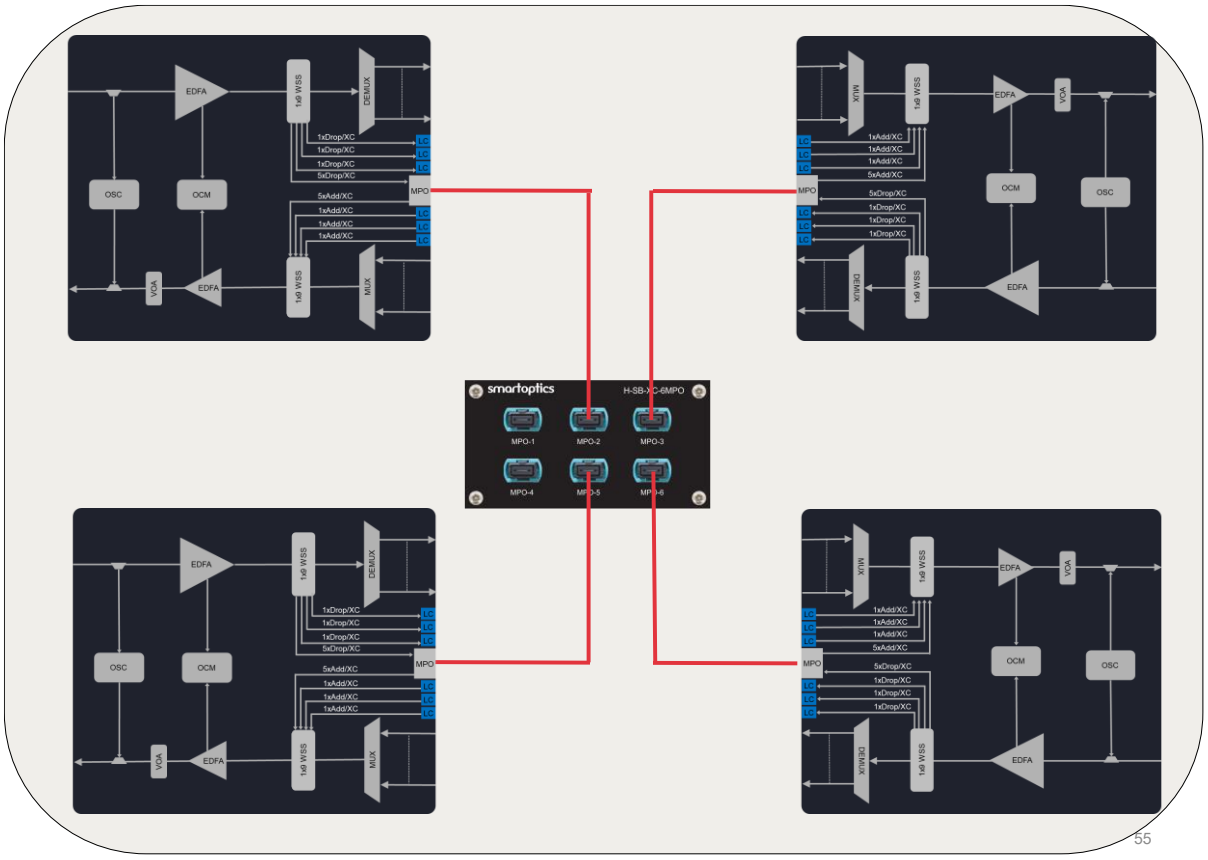


Figure 6. *Functional diagram of a 4D ROADM node with four DCP-R-9D-CS and one shuffle box.*

10 fibers are used in each MPO cable that is connected to the ROADM box. It is 5 cables for transmit and 5 for receive so in total 5 fiber pairs.

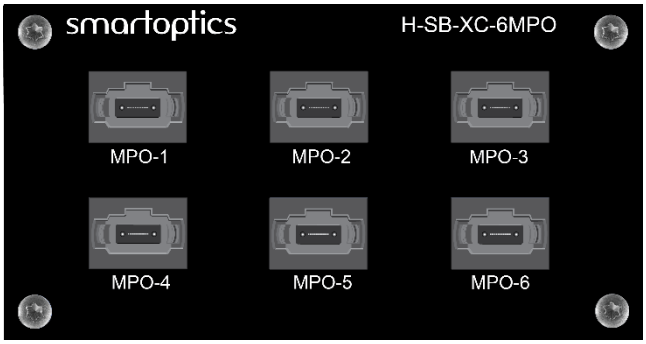


Figure 7. *Front view of a shuffle box.*

2.1.3 9 Degree ROADM Application

The 9 degree ROADM nodes will require both a shuffle box and three breakout boxes for simplest fiber management. Both the shuffle box and the breakout boxes are passive units that can be mounted in the H-series frame.

Interconnection between the first 6 degrees is done via the shuffle box in the same way as for the 4D ROADM. For the additional 3 degrees it is recommended to use one breakout box for each degree. The ROADM MPO port is then connected to the MPO port on the breakout box. XC ports 5-9 will then be available via LC connectors on the breakout box.

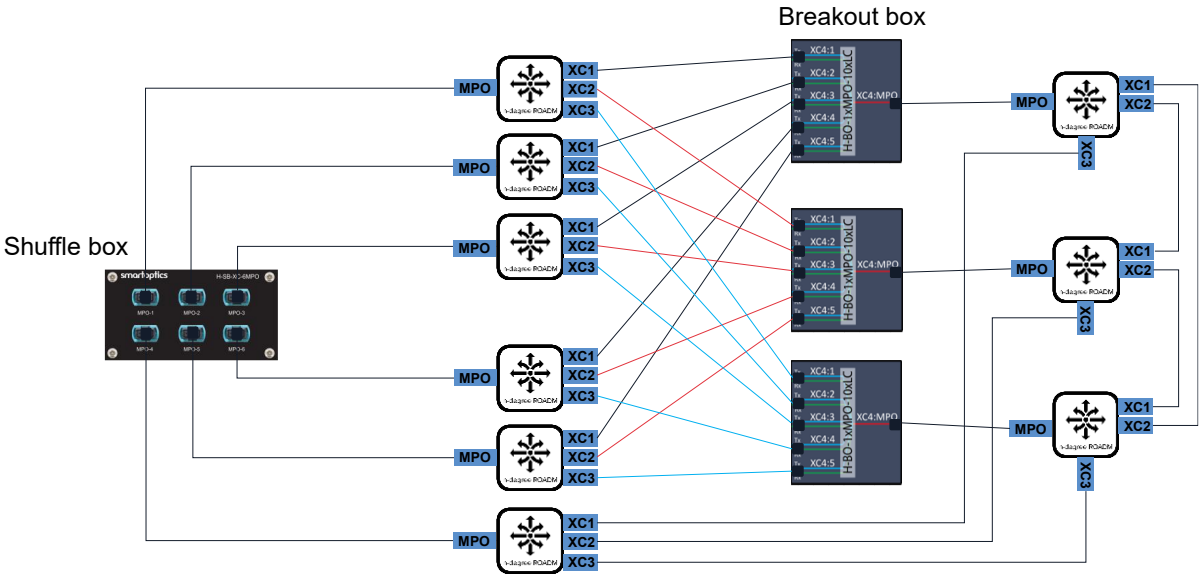


Figure 8. *Functional diagram of a 9D ROADM node with one shuffle box and three breakout boxes.*

Note that 2 shelf controllers are needed for a 9D ROADM if the version CCR2004-16G-2S+ is used. This is because there is not enough Ethernet ports on one shelf controller of this type.

2.2 DCP-R-34D-CS

The DCP-R-34D-CS product is a “ROADM on a blade” solution with everything needed for one ROADM degree in a 1RU chassis. This unit is optimized for transport of coherent services that will not require tunable dispersion compensation, but it can also be used for other services if external dispersion compensation is used.
DCP-R-34D-CS can be used in ROADM configurations up to 12 degrees.

This chassis has front to back air flow and can use AC or DC power. The power and FAN units are redundant and can be replaced. They are accessed from the rear side of the chassis.

Figure 9. *Chassis front view of DCP-R-34D-CS*

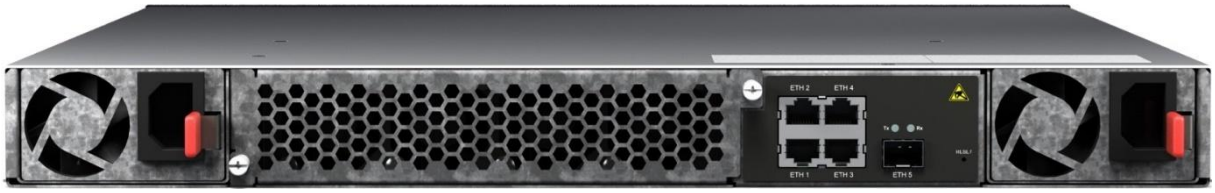


Figure 10. *Chassis rear view of DCP-R-34D-CS*

The DCP-R-34D-CS contains a twin 1x34 Flexgrid WSS, OCM, booster and pre-amplifier, a VOA for the line side and OSC filters. The OSC channel uses a pluggable SFP to support different distances. The OSC port can also use special SFPs for combined OSC+OTDR functionality.

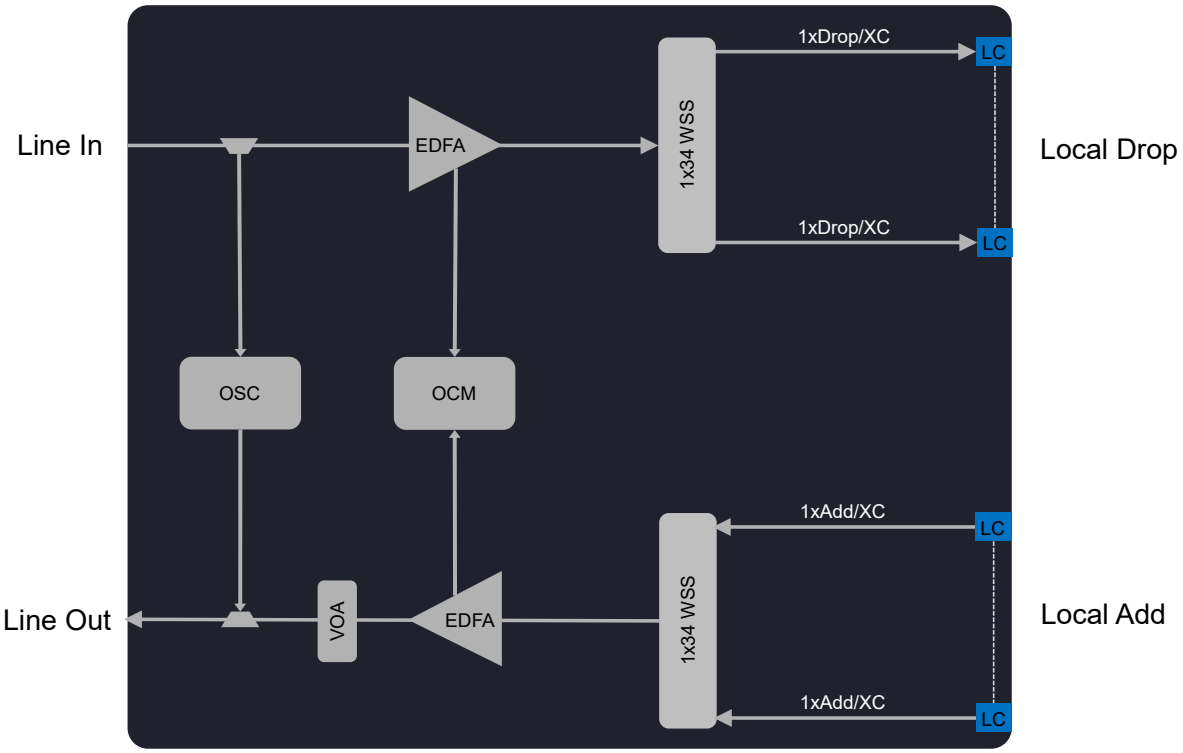


Figure 11. *Functional diagram of DCP-R-34D-CS*

2.3 Configurations and settings

2.3.1 automationMode

Automation mode decides how the unit operates. In managedCLI mode the unit is managed from the CLI. In managedNetconf mode the unit is managed over Netconf from an SDN controller. Two modes are available:

- **managedCLI** - In managedCLI mode the unit is managed from the CLI.
  managedNetconf - In managedNetconf mode the channel control parameters are only configurable over Netconf. Other general parameters are still available in CLI.
  The CLI configurations that are not available are:
  - Config interface if-d/9xxx opticalControlMode
  - Config interface if-d/9xxx portMode
  - Config interface if-d/line targetOutputPower

2.3.2 opticalControlMode

The opticalControlMode decides how the WSS attenuation is regulated for a specific channel. Three modes are available:

- **gainLoss** : In gainLoss mode the WSS attenuation for a channel is fixed to the latest setting. Optical light can pass, but will not be regulated.
- **off** : In off mode the WSS attenuation value for that channel is maximum so as much as possible of the channel power is blocked.
- **power** : In power mode the channel is regulated towards a wanted power value on Line Tx in dBm. The WSS attenuation is changed so that the wanted power is reached.

After cold start the node will start up with same settings as before the cold start, e.g. the WSS attenuation will be the same as before. This will ensure quick recovery of the traffic after a power failure.

2.4 OSC

The OSC enables turning up of the optical layer without any service wavelengths and once a connection is established between the sites a communication channel is created and actual distance is measured as well as optical span loss. For actual distance the values are only measurable (and updated) upon OSC initialization with the far-end, new updated values occur only after fiber reconnect or cold restart.

2.4.1 show osclinkview

This command presents the operational and optical status of the link/optical line between the sites. The displayed parameters contain information from the OSC only. A more detailed output is available using the command ‘show osclinkview detail’.

```
admin@dcpf-189>show osclinkview
  Local system                                 Fiber            Remote system
  =========================================  ===============  =========================================
                                       Power  Loss             Power
  Hostname  Interface    Status  Alarm  [dBm]  [dB]  Direction  [dBm]  Interface     Hostname
  --------  -----------  ------  -----  -----  ----  ---------  -----  ------------  --------------------
  dcpf-189  if-1/1/2-tx  up      ok       3.7  11.8    >>>>>     -8.1  if-1/line-rx  DCP-M40-PAM4-ER---180
  dcpf-189  if-1/1/2-rx  up      ok     -16.8  11.1    <<<<<     -5.7  if-1/line-tx  DCP-M40-PAM4-ER---180
  dcpf-189  if-1/2/2-tx  up      ok       3.3  10.3    >>>>>     -7.0  if-1/line-rx  DCP-M40-PAM4-ER---181
  dcpf-189  if-1/2/2-rx  up      ok     -21.1   0.2    <<<<<    -20.9  if-1/line-tx  DCP-M40-PAM4-ER---181

admin@dcpf-189>
```

Figure 12. *Example of OSC link view*

This command shows the status of the link, the optical power levels at Tx and Rx for both local and remote sites, the link loss and alarm status.

Column definitions:

- Local System: This section presents the parameters for the local system.

- Hostname: Name of the local system.
- Interface: Identifying Line Tx or Rx port.

- Status: Identifies the status of the Tx and Rx port. Status level can be up, down or idle. Idle is present if the channel has never been activated.
- Alarm: Identifies the alarm status of the port/interface.
- Power: Optical OSC power present at the line interface.

- Fiber: This section presents the parameters of the fiber between the systems.

- Loss: Calculated fiber loss between the systems.
- Direction: Illustrating the direction of the light travelling in the fiber.

- Remote System: This section presents the parameters for the remote system and uses the same definitions as the local system.

2.4.1.1 show osclinkview detail

```
admin@dcpf-189>show osclinkview detail
  Local system                                    Fiber                                                    Remote system
  ============================================    ======================================================   ============================================
                                        Power   Loss  Attenuation  Length  Disp.                         Power
  Hostname  Interface    Status  Alarm  [dBm]   [dB]  [dB/km]      [km]    [ps/nm]  Fiber  Direction     [dBm]  Interface     Hostname
  --------  -----------  ------  -----  -----   ----  -----------  ------  -------  -----  ----------    -----  ------------  --------------------
  dcpf-189  if-1/1/2-tx  up      ok       3.7  11.8         0.29    40.3      673  G.652    >>>>>        -8.1  if-1/line-rx  DCP-M40-PAM4-ER---180
  dcpf-189  if-1/1/2-rx  up      ok     -16.8  11.1         0.27    40.3      673  G.652    <<<<<        -5.7  if-1/line-tx  DCP-M40-PAM4-ER---180
  dcpf-189  if-1/2/2-tx  up      ok       3.3  10.3            -     0.0        -  G.652    >>>>>        -7.0  if-1/line-rx  DCP-M40-PAM4-ER---181
  dcpf-189  if-1/2/2-rx  up      ok     -21.1   0.2            -     0.0        -  G.652    <<<<<       -20.9  if-1/line-tx  DCP-M40-PAM4-ER---181

admin@dcpf-189>
```

Figure 13. *Example of detailed OSC link view*

The detail command gives access to additional fiber link parameters.

Additional column definitions:

- Length: Measured fiber length by the local system.
- Disp: Displays the calculated dispersion based on the measured fiber length.
- Fiber: Displays the fiber type configured, currently only G.652 is supported.
- Direction: Illustrating the direction of the light travelling in the fiber.

2.5 Optical Time Domain Reflectometer, OTDR

Combined OSC/OTDR SFPs are supported in DCP-R. OTDR CLI commands can be found in the “DCP-CLI User Manual”.

An Optical Time Domain Reflectometer, OTDR, is a unit that will send out short optical pulses into a fiber and measure the time for reflections to return. The measured time is then recalculated into distance. Then the OTDR will provide a table with distances to reflection points, e.g. ODFs, bad splices, fiber cuts etc.

Event ID	Distance (m)
1	xx
2	yy
3	zz

Figure 14. *Example of a table with reflection points for an OTDR measurement*

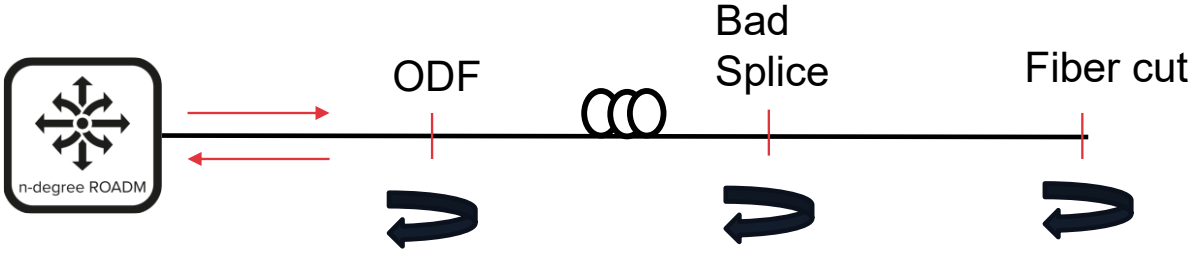
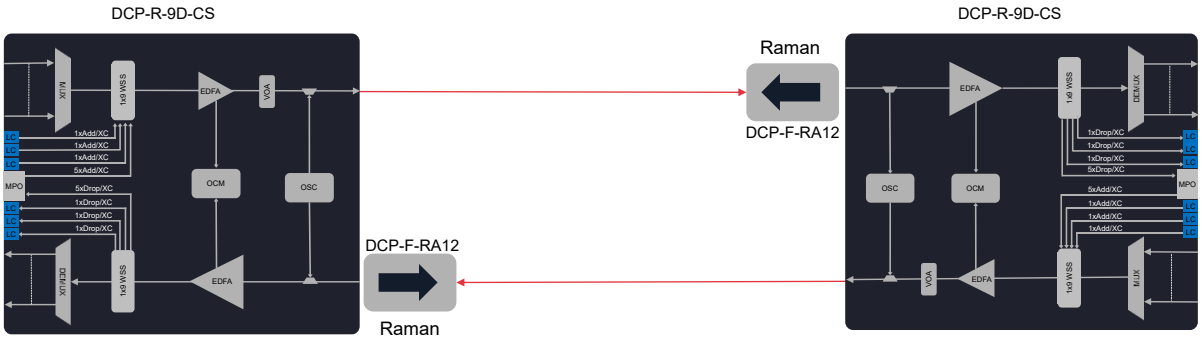


Figure 15. *Example of reflection points in OTDR measurements*

The OTDR-SFPs can be used for both OSC and OTDR functionality. Two different CWDM wavelengths are supported in this release; 1491, 1511nm. In DCP-R, because of the inbuilt 1510 nm filter, the 1511 nm version is recommended. Two different bit rates are available, 155Mb/s and 1Gb/s, but it is recommended to use 1G version if the OpenROADM standard should be met.

2.6 Raman unit

The distance can be extended by adding Raman amplifiers in addition to booster and pre-amp EDFAs. The Raman amplifier should be used in counter propagating mode, i.e. it should sit at the receiving end of the fiber and inject optical light in the reverse direction compared to the optical signal.



It is possible to use Raman units (DCP-F-RA12) together with DCP-R. These Raman units will have their own DCP-2 chassis and their IP. For operation with ROADM, it is necessary to write the Raman gain and Raman VOA settings in the ROADM CLI. In R11.1 it is not possible for the DCP-R to read this automatically.

See DCP-F manual

Use following steps to enter the Raman gain and VOA settings in the ROADM node.

1. Login to the DCP-2 chassis with the Raman unit
2. Read Raman gain and VOA attenuation.
3. Login to the ROADM node
4. Enter the Raman gain and VOA attenuation. Note that it is the actual Raman gain that should be entered. It might be higher or lower than the wanted gain.
   Example with gain 12dB and VOA 9dB
   config interface if-1/line RamanWDMGainRx 12
   config interface if-1/line RamanVOARx 9

2.7 Physical Description

The DCP-R is a compact unit, intended for installation in 19” racks or on shelves. The unit height is 1U (1.77 in). Power and fan units are located in the back panel. Management connections are available both in the front and rear sides of the chassis. All optical connections are done on the front panel. The DCP has a front-to-back airflow. The DCP-R chassis is populated with 2 redundant power supplies and 1 fan unit (with 4 fans).
DCP-R is available in two versions DCP-R-9D-CS and DCP-R-34D-CS.

Figure 16. *Chassis front view of DCP-R-9D-CS*

Figure 17. *Chassis front view of DCP-R-34D-CS*

The front of the chassis includes one RJ45 Ethernet port and one RS232 serial port for management connections.

Figure 18. *Chassis rear view of DCP-R-9D-CS and DCP-R-34D-CS*

The back of the DCP-R chassis houses 4xRJ45 Ethernet ports for management access. The ETH5 port and can be used with an optical SFP interface. The 2 power supplies and fan-unit are hot pluggable.

2.8 Power supplies

In the figure below two power supplies are shown. The left power supply, DCP-2-PSU-AC-FB, is supporting 100-127 VAC and 200-240 VAC. The right power supply, DCP-2-PSU-DC-FB, supports -40 to -72 VDC. The DCP-R is dual feed and the power supplies are hot swappable. Both types can be used simultaneously.

Figure 19. *The DCP-2-PSU-AC-FB and DCP-2-PSU-DC-FB unit.*

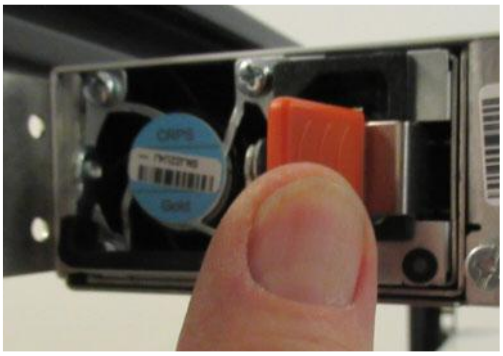
Same power supplies are also used in DCP-M and DCP-2 chassis.

2.8.1 Installing Power supplies (AC and/or DC)

1. Slide the power supply module into the power supply slot until you hear a click.
2. Push/pull on the black handle to ensure that it is engaged to the backplane connector.

2.8.2 Replacing a Power supplies

1. Remove the power cord
2. Push the locking lever in towards the power connector.
3. Lift the handle and pull out the power supply.
4. Install the new power supply (as previously described).
5. Reconnect the power cord



2.9 DCP-2-FAN-FB Fan Unit

The DCP-R has a fan unit which consists of 4 fans. The fan speed is controlled via the MCU and the system can operate with 3 working fans. If one fan fails the other 3 will speed up to compensate and an alarm will trigger to replace the fan unit.

Figure 20. *The DCP-2-FAN-FB unit.*

2.9.1 Replacing DCP-2-FAN-FB Fan Unit

NOTE - To prevent overheating, install the replacement fan tray immediately after removing the existing fan tray.

1. Loosen the screws on each side of the fan tray faceplate.
2. Grasp both sides of the fan tray and pull it out

WARNING - To avoid injury, keep tools and your fingers away from the fans as you slide the fan module out of the chassis. The fans might still be spinning.

2.9.2 Installing DCP-2-FAN-FB Fan Unit

1. Grasp the fan tray on each side and insert it straight into the chassis.
2. Tighten captive screws on each side of the fan tray faceplate to secure it in the chassis to a torque of 17 cm-kg (15 in-lb.)

Figure 21.

2.10 Network Management Interfaces

The Network Management Interface is a part of the DCP-R chassis. Management connections are available both in the front and rear sides of the chassis. The management system collects and controls system relevant information.

The module has:

- RS232 - 1x RS232 port in the front for serial access to the chassis and initial setup.
- ETH1/ETH2/ETH3/ETH4 - 4x 100/1000Base-T interfaces in the back to be connected to the shelf controller . See “Shelf controller User Manual” for details on the functionality of each port.
- ETH5 - 1x SFP port 100/1000Base-X in the back for optical management access to the chassis. See “Shelf controller User Manual” for details on the functionality of each port.
- ETH0 - 1x 100/1000Base-T “local” port access in the front for engineers onsite. Default IP address of the ETH0 port is 192.168.0.1.

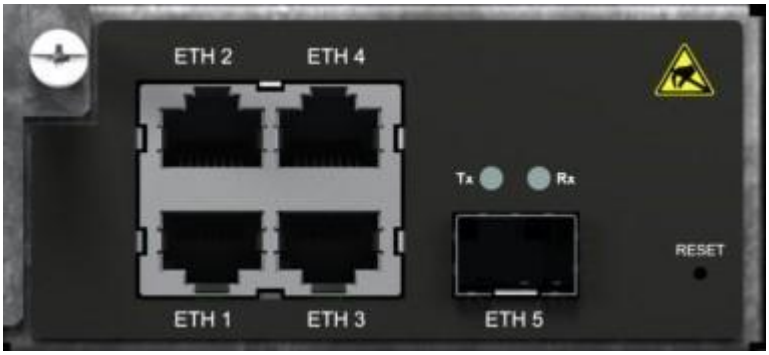


Figure 22. *Network management communication interfaces in the back of the DCP-R chassis.*

Figure 23. *Network management communication interfaces in the front of the DCP-R chassis.*

2.11 Management architecture

The below figure shows the architecture of the system management. The current implemented APIs are CLI, SNMP and Netconf. External REST interface is not available in R10.1.1.

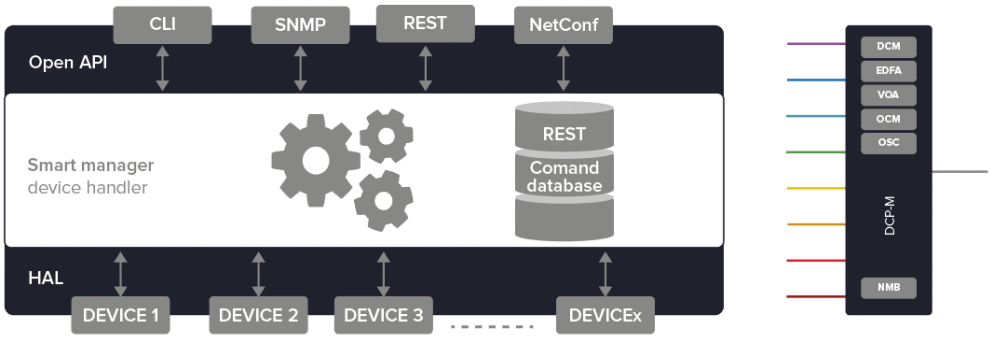
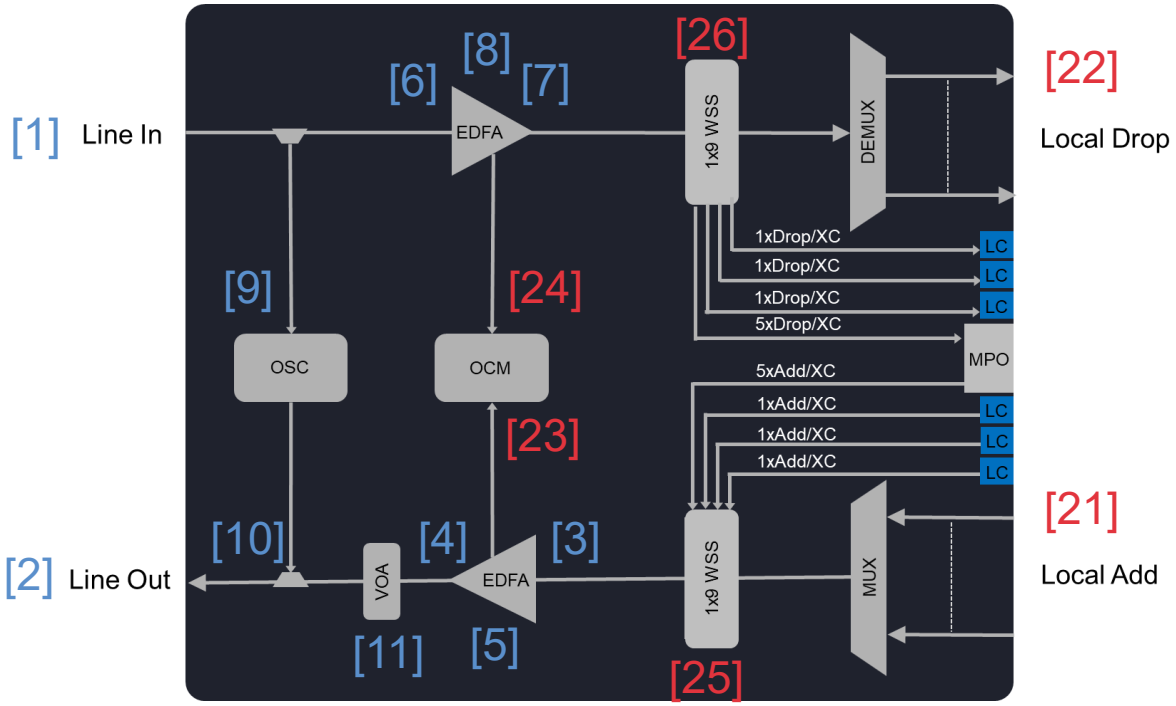


Figure 24. *Management architecture.*

2.12 Monitor points

The illustration below indicates the optical monitor points of the DCP-R. The red numbers in the illustration indicate monitor points per channel of the system, while the blue numbers indicate the line side monitor points.



The parameters for the line side can be presented with the command:
show interface if-1/line (for degree 1)

See example below.

```
admin@BRU-R1-ROADM-201>show interface if-1/line

  Interface       : if-1/line
  Description     : COL-R2-ROADM-202-D2

  Status:

  Status [Rx/Tx]   : up/up

[1] Optical Rx power     :  -2.8 [dBm]
[2] Optical Tx power     :  -2.2 [dBm]
    Average Ch Tx power  :     - [dBm]

[3] Booster EDFA Rx power          : -16.3 [dBm]
[4] Booster EDFA Tx power          :   6.1 [dBm]
    Booster EDFA wanted gain       :  22.0 [dB]
[5] Booster EDFA actual gain       :  22.0 [dB]
    Booster EDFA min gain threshold :  20.0 [dB]
    Booster EDFA max gain threshold :  24.0 [dB]
    RamanWDMGainRx                 :   0.0 [dB]
    RamanVOARx                     :   0.0 [dB]

[6] Pre-amp EDFA Rx power          : -12.7 [dBm]
[7] Pre-amp EDFA Tx power          :   9.4 [dBm]
    Pre-amp EDFA wanted gain       :  22.0 [dB]
[8] Pre-amp EDFA actual gain       :  22.0 [dB]
    Pre-amp EDFA min gain threshold :  22.0 [dB]
    Pre-amp EDFA max gain threshold :  22.0 [dB]

[9] OSC Rx power   :  -3.3 [dBm]
[10] OSC Tx power  :  -2.7 [dBm]
    Rx sensitivity  : -34.0 [dBm]

[11] VOA attenuation             : 16.6 [dB]
    VOA insertion loss           : 1.2 [dB]
    VOA preset mode              : auto
    Fiber mode                   : dualFiber
    Target output power          : -15.2 [dBm]
    Power offset                 :  0.0 [dB]
```

The parameters per channel can be presented with the command:
show interface if-1/19370000 (for channel 193.7 THz on degree 1)

See example below.

```
admin@BRU-R1-ROADM-201>show interface if-1/19370000

  Interface       : if-1/19370000
  Description     :

Status:

  Status [Rx/Tx]   : up/up

  Wavelength      : 1547.72 [nm]
  Channel Id      : 19370000
  Frequency       : 193.70000
  Width           : 100.0

[21] Optical Rx power     : -10.8 [dBm]
[22] Optical Tx power     :  -7.9 [dBm]
[23] Booster OCM ch power :   0.4 [dBm]
[24] Pre-amp OCM ch power :   5.7 [dBm]

  Format detection : manual
  Format           : Coherent

  Optical control mode : gainLoss
  Target output power  : -15.2 [dBm]
  Actual output power  : -18.0 [dBm]
  Port mode            : localAD

[25] WSS add attenuation  :   2.2 [dB]
[26] WSS drop attenuation :   5.0 [dB]
```

2.13 Alarms

The DCP-R keeps a list of the alarms currently detected on the system and collected by the system. When an alarm is detected, it is added to the active alarm list. When the alarm is cleared the alarm is removed from the active alarm list. Previously cleared alarms can be found in the alarm log.

The following information is stored for each alarm:

Start time: The date and time when the alarm was detected.

End time: The date and time when the alarm was cleared.

Location: The entity that caused the alarm.

Severity: The severity of the alarm.

All possible alarms can be listed with the command:
show alarm list

ALARM MESSAGE	LOCATION	SEVERITY	INTERPRETATION
Loss of optical input power	if-<chassi>/<slot>/<Interface>	Critical	The optical power of the interface has gone below the minimum power level. Check the fiber connection and/or clean the fiber connector.
Loss of optical output power	if-<chassi>/<slot>/<Interface>	Critical	
Loss of optical input power(OSC)	if-<chassi>/<slot>/<Interface>	Major	The OSC optical power has gone below the minimum power level. It could be because the remote ends OSC is administratively disabled or that the dark fiber has been cut or disconnected.
Loss of optical input power(Line)	if-<chassi>/<slot>/<Interface>	Critical	The optical input power in to the pre-amplifier is below the minimum level.
Loss of OSC link	if-<chassi>/<slot>/<Interface>	Major	Loss of OSC link indicates there is no communication to the remote hosts OSC channel.
Fan failure	fan-<chassi>/1	Major	Fan unit has failed. Replace within 24 hours.
Fan missing	fan-<chassi>/1	Critical	Fan is missing in chassis.
Power supply failure	psu-<chassi>/1 psu-<chassi>/2	Major	Input AC/DC power is lost on the unit
External power missing	psu-1/1 psu-1/2	Minor	This alarm appears when the external power is not connected or not working.
Power supply fan failure	psu-1/1 psu-1/2	Minor	The fan unit in the power supply has failed
Power supply communication failure	psu-1/1 psu-1/2	Major	The chassis cannot communicate with the power supply unit
Power supply input voltage high	psu-1/1 psu-1/2	Minor	The input voltage is too high
Power supply input voltage low	psu-1/1 psu-1/2	Minor	The input voltage is too low
Power supply missing	psu-<chassi>/1 psu-<chassi>/2	Critical	This alarm appears when the unit is not inserted.
Power supply unsupported	psu-<chassi>/1 psu-<chassi>/2	Major	This alarm appears if an unknown power supply unit is inserted.
Node member connection lost		Major	Connection to a slave chassis is lost

Software version mismatch	chassis	Major	The chassis has a different SW version than the shlef controller. Note that this alarm is not implmented for ILAs with shelf controllers in R8.1.3
Low disk space	chassis	 Minor Major Critical	Check current disk space with command “show system diskUsage” <5MB available <7.5MB available <10MB availale
eMMC failure	chassis	Critical	The memory is not formatted. Contact support.

2.14 Backup and restore

The backup and restore functionality is not available for solutions with DCP-SC-28P.

The backup and restore functionality is available for solutions with SO-SHELF-CTRL-XX. This is needed for replacement of DCP-R in single degree nodes. It is not needed for replacement of DCP-R chassis in multi-degree nodes. This is because the configuration is saved on other units in the same node cluster (on other DCP-R units or on shelf controller). See chapter about node replacement.
The backup file can be used if all units in the same node cluster fail and the node has to be recreated from scratch.

Backup files can be created and uploaded to a remote server for reference configuration that can be used for fault finding for support.

Only one backup file is allowed. The backup file will be removed at reboot.

2.15 Virtual ports

In the default configuration for DCP-R, there is a pre-defined number of services that can be configured per physical XC port. For DCP-R-9D-CS the default number is 16 and for DCP-R-34D-CS the default number is 1. If more services are needed, it is possible to configure additional virtual ports. Virtual ports could be used when external filters, couplers or ROADM units are connected to physical XC ports.

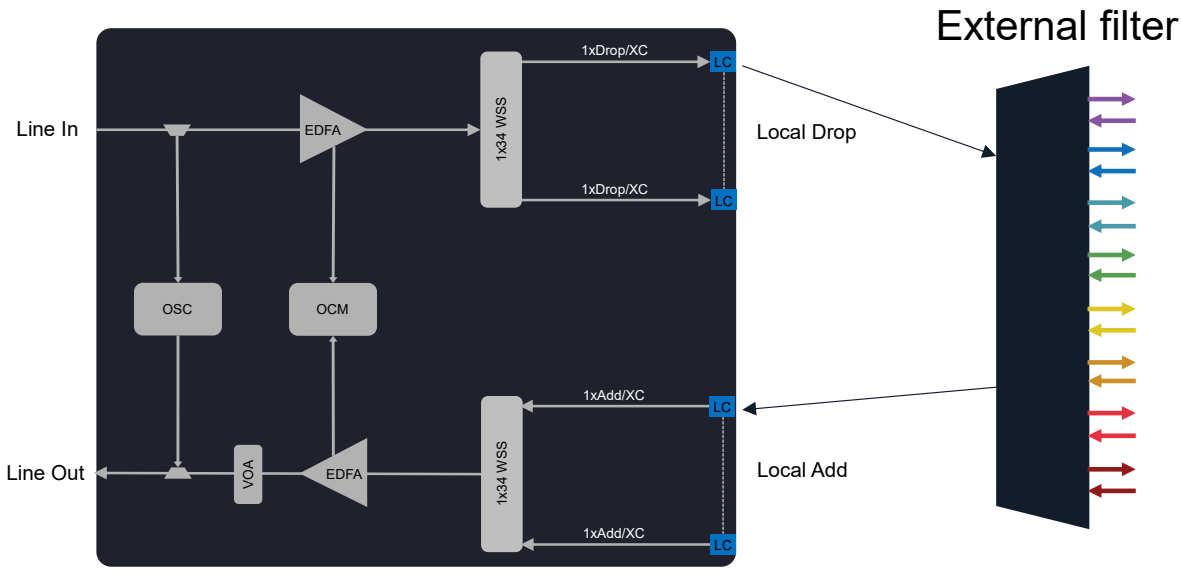


Figure 25. *DCP-R-34D-CS with external filter using virtual ports*

The maximum number of virtual ports per degree is 128. This is because the minimum width per frequency slot is 37.5GHz and the total spectrum is 4800GHz. The maximum number of virtual ports will also depend on the shelf controller memory.

Max number of virtual ports per XC port with DCP-SC-28P: 128

Max number of virtual ports per XC port with SO-SHELF-CTRL-XX: 16

Note that virtual ports should be created from CLI before they can be used in SoSmart. It is also possible to delete virtual ports from CLI, but they will still be visible in SoSmart after deletion. This is valid for SoSmart R6.1.1.

3 Installation and Safety

3.1 Safety Precaution

Fasten the chassis securely to a 19”-rack.

Insert the PSU in the chassis and connect it to the power source. The chassis will automatically power up as soon as the PSU is connected.

3.1.1 General Safety Precautions

The following are the general safety precautions:

The equipment should be used in a restricted access location only.

No internal **settings**, adjustments, maintenance, and repairs may be performed by the operator or the user; such activities may be performed only by skilled service personnel who are aware of the hazards involved.

Always observe standard safety precautions during installation, operation, and maintenance of this product.

3.1.2 Electrical Safety Precautions

Warning: Dangerous voltages may be present on the cables connected to the DCP-R.

Never connect electrical cables to a DCP-R unit if it is not properly installed and grounded.

Disconnect the power cable before removing a pluggable power supply unit.

Grounding: For your protection and to prevent possible damage to equipment when a fault condition occurs on the cables connected to the equipment (for example, a lightning strike or contact with high voltage power lines), the case of the DCP-R unit must be properly grounded at all times. Any interruption of the protective (grounding) connection inside or outside the equipment, or the disconnection of the protective ground terminal, can make this equipment dangerous. Intentional interruption is prohibited.

When a DCP-R is installed in a rack, make sure that the rack is properly grounded and connected to a reliable, low resistance grounding system.

Connect the DCP-R via an external cable to ground. See Section 3.2.8 for further details.

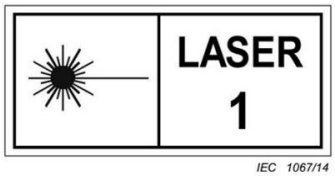
The grounding must also be made through the AC power cable, which should be inserted in a power outlet with a protective ground contact. Therefore, the power cable plug must always be inserted in a socket outlet provided with a protective ground contact, and the protective action must not be negated by use of an extension cord (power cable) without a protective conductor (grounding).

3.1.3 Laser Safety Classification

The DCP-R complies with Class 1. The incorporated laser has a divergent beam, operates within the wavelength span of 1530 – 1563 nm and has a maximum output of +20 dBm.

The following warning applies to Class 1 laser products.

Invisible Laser Radiation: Do not view directly with optical instruments.



Class 1 Laser Warning.

Laser Safety Statutory Warning and Operating Precautions

All personnel involved in equipment installation, operation, and maintenance must be aware that the laser radiation is invisible. Therefore, the personnel must strictly observe the applicable safety precautions and in particular, must avoid looking straight into optical connectors, either directly or using optical instruments.

In addition to the general precautions described in this section, be sure to observe the following warnings when operating a product equipped with a laser device. Failure to observe these warnings could result in fire, bodily injury, and damage to the equipment.

Warning: To reduce the risk of exposure to hazardous radiation:

Do not try to open the enclosure. There are no user serviceable components inside.

Do not operate controls, adjust, or perform procedures to the laser device other than those specified herein.

Allow only authorized service technicians to repair the unit.

3.1.4 Protection against Electrostatic Discharge

An electrostatic discharge (ESD) occurs between two objects when an object carrying static electrical charges touches or is brought near the other object. Static electrical charges appear as a result of friction between surfaces of insulating materials or separation of two such surfaces. They may also be induced by electrical fields.

Routine activities, such as walking across an insulating floor, friction between garment parts, and friction between objects, can easily build charges up to levels that may cause damage, especially when humidity is low.

Caution: DCP-R internal boards contain components sensitive to ESD. To prevent ESD damage, do not touch internal components or connectors. If you are not using a wrist strap, before touching a DCP-R or performing any internal settings on the DCP-R, it is recommended to discharge the electrostatic charge of your body by touching the frame of a grounded equipment unit.

Whenever feasible during installation, use standard ESD protection wrist straps to discharge electrostatic charges. It is also recommended to use garments and packaging made of anti-static materials, or materials that have a high resistance, yet are not insulators.

3.1.5 Site Requirements

This section describes the DCP-R site requirements.

PHYSICAL REQUIREMENTS

The DCP-R unit can be mounted in a 19-inch, 23-inch, or ETSI rack with the GND cable connected. The rack depth needs to be at least 600 mm.

All the electrical connections are made to the back panel. The optical traffic connections are made in the front panel.

POWER REQUIREMENTS

AC-powered DCP-R units should be installed within 3m (10 feet) of an easily accessible, grounded AC outlet capable of furnishing the required AC supply voltage, of 100-127VAC (3A) and 200-240VAC (1,5A) maximum.

DC-powered DCP-R units require a -48VDC (-40V to -72V) (Max 7A @ -48V) DC power source with the positive terminal grounded. In addition, the DC power connector contains the chassis (frame) ground terminal.

AMBIENT REQUIREMENTS

The ambient operating temperature of the DCP-R is 0° to +45°C/+32° to +113°F, at a relative humidity of 5% to 85% RH non-condensing.

The DCP-R is cooled by free air convection and a pluggable cooling FAN unit. The DCP supports front-to-back cooling. The air inlets and outlets are positioned in the front and back.

Caution: Do not obstruct these vents.

The DCP-R contains a fan speed control for lower noise, improved MTBF, and power savings.

ELECTROMAGNETIC COMPATIBILITY CONSIDERATIONS

The DCP-R is designed to comply with the electromagnetic compatibility (EMC) requirements according to ETSI EN 300 386 V2.1.1 class A. To meet these standards, the following conditions are necessary:

The DCP-R must be connected to a low resistance grounding system.

The RJ45 Ethernet interfaces ETH0 – ETH4 can be used for intra-building connections provided that a Cat 5e (or higher) class shielded cable is used. The cables must not be electrically connected directly to outside-plant cables.

Warning: The intra-building port(s) (ETH0-ETH4 management ports) of the equipment or subassembly is suitable for connection to intra building or unexposed wiring or cabling only. The intra-building port(s) of the equipment or subassembly MUST NOT be metallically connected to interfaces that connect to the OSP or its wiring. These interfaces

are designed for use as intra-building interfaces only (Type 2 ports as described in GR-1089-CORE) and require isolation from the exposed OSP cabling. The addition of Primary Protectors is not sufficient protection in order to connect these interfaces metallically to OSP wiring.

Warning: The intra-building port(s) (ETH0-ETH4 management ports) of the equipment or subassembly must use shielded intra-building cabling/wiring that is grounded at both ends.

Maximum allowed cable length for intra-building connections is 100m.

The DCP-R must be installed in a CBN (common bonding network) per NEBS GR-1089.

The DCP-R is designed to be used in Network Telecommunication Facilities.

Common DC return (DC-C) Is applicable for the DCP-R.

3.2 Rack mounting

The following instructions provides detail how to mount the system in racks that are 600 mm to 1200 mm deep (24”- 48”).

The system can be mounted in a rack in the following ways:

1. With the front side flush with the front of the rack posts. (Four-Post Rack).

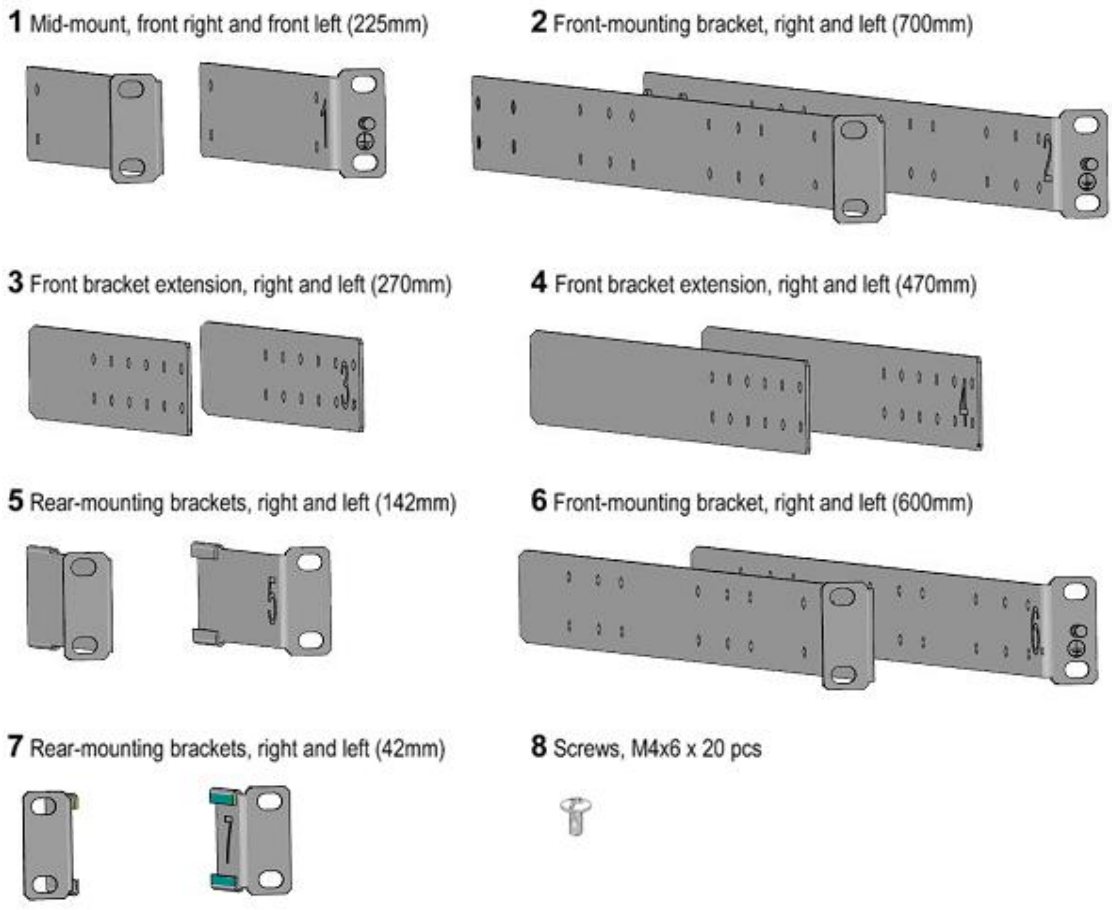
2. With the front side in a recessed position. A recessed position allows a more gradual bend in the fiber-optic cables connected and less interference in the aisle at the front of the rack (Four-Post Rack).

3. With the rack posts mounted to the mid-section of the system (Two-Post Rack).

3.2.1 Rack-mount kit parts list

The following parts are provided with the rack-mount kit.

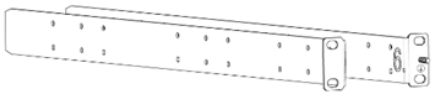
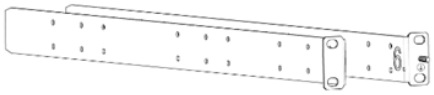
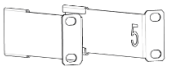
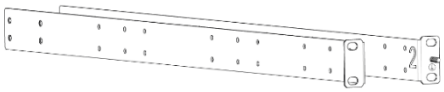
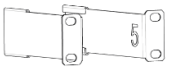
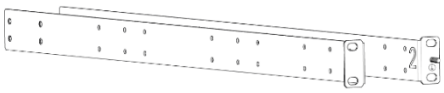
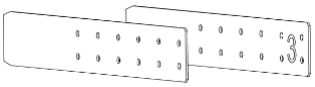
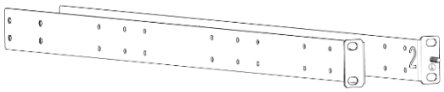
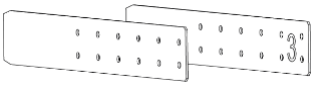
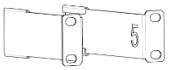
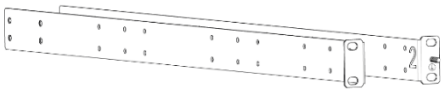
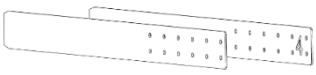
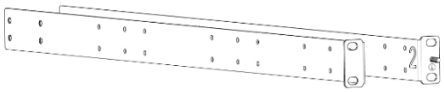
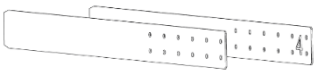
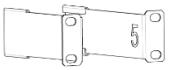
1. Mid-mount, front right and front left (225mm)
2. Front-mounting Bracket, right and left (700mm)
3. Front bracket extension, right and left (270mm)
4. Front bracket extension, right and left (470mm)
5. Rear-mounting brackets, right and left (142mm)
6. Front-mounting Bracket, right and left (600mm)
7. Rear-mounting brackets, right and left (42mm)
8. Screws, M4x6, Phillips (20 pcs)



3.2.2 Determining bracket configuration

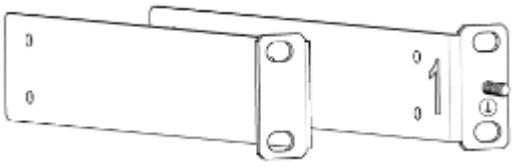
3.2.2.1 4-Post Rack

The bracket configuration to use depends on the depth of the rack where the system is installed into. Use the following table to determine the correct bracket configuration.

	Rack-kit Parts		
Rack Depth	**Front bracket**	**Middle extension**	**Rear bracket**
600 mm 24”	 **6**		 **7**
600 – 700 mm 24” - 28”	 **6**		 **5**
700 – 820 mm 28” - 32”	 **2**		 **5**
800 – 900 mm 32” - 36”	 **2**	 **3**	 **7**
840 – 1000 mm 34” - 40”	 **2**	 **3**	 **5**
1000 – 1100 mm 40” - 44”	 **2**	 **4**	 **7**
1100 – 1200 mm 44” - 48”	 **2**	 **4**	 **5**

3.2.2.2 2-Post Rack

For a 2-post rack, use part number one. Refer to chapter 3.2.6 for mounting instructions.



Part number 1.

3.2.3 Chassis flush or recessed position mounting

Complete the following steps to attach the front brackets to the system.

1. Position the right front-mounting bracket with the flat side against the front right side of the system.
2. Insert five M4x6 screws through the vertically aligned holes in the bracket and then into the holes on the side of the system.
3. Position the left front-mounting bracket with the flat side against the front left side of the system.
4. Insert six M4x6 screws through the vertically aligned holes in the bracket and then into the holes on the side of the system.
5. Tighten all the eleven M4x6 screws to a torque of 17 cm-kg (15 in-lb.).

3.2.4 Attaching the bracket extensions to the front brackets

Complete the following steps to attach the extension brackets to the front brackets.

1. Position the right bracket extension along the side of the front-mounting bracket.
2. Insert four M4x6 screws through the vertically aligned holes in the bracket extension and then into the holes on the front-mounting bracket.
3. Repeat step 2 and step 3 to attach the left bracket extension to the front-mounting bracket.
4. Tighten all the eight M4x6 screws to a torque of 17 cm-kg (15 in-lb.).

3.2.5 Attaching the rear brackets to the rack posts

Complete the following steps to attach the rear brackets to the rack posts.

1. Attach the right rear-mounting bracket to the right rear rack post using two screws and two retainer nuts.
2. Attach the left rear-mounting bracket to the left rear rack post using screws and two retainer nuts.
3. Tighten all the screws to a torque of 29 cm-kg (25 in-lb.).

3.2.6 Attaching brackets for mid-mounting

Complete the following steps to attach the front brackets to the system.

1. Position the right mid-mount bracket with the flat side against the right side of the system.
2. Flip it over so that the L-shaped bracket angle is placed inwards.
3. Insert three screws through the vertically aligned holes in the bracket and then into the holes on the side of the system.
4. Position the left mid-mount bracket with the flat side against the left side of the system.
5. Insert four screws through the vertically aligned holes in the bracket and then into the holes on the side of the system.
6. Tighten all seven M4x6 screws to a torque of 17 cm-kg (15 in-lb.).

3.2.7 Installing the system in the rack

Complete the following steps to install the system in the rack.

1. Position the system in the rack, providing temporary support under the system until it is secured to the rack.
2. If applicable, slide the right and left front-mounting brackets into the rear-mounting brackets that should already be mounted at the rear posts of the rack.
3. Attach the right front-mounting bracket to the right front rack post using two screws and two retainer nuts.
4. Attach the left front-mounting bracket to the left front rack post using screws and two retainer nuts.
5. Tighten all the screws to a torque of 29 cm-kg (25 in-lb.).

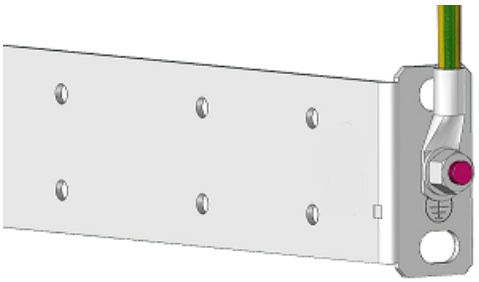
3.2.8 Protective Ground Terminal

Connecting the DCP chassis to earth ground is required for all DC powered installations, and any AC powered installation where compliance with Telcordia grounding requirements is necessary.

Before connecting power to the device, the grounding terminal must be connected to ground to ensure proper operation and to meet electromagnetic interference (EMI) and safety requirements.

The front rack mount brackets include a grounding terminal. The surface area around this terminal is not painted to provide a good electrical connection. It is located on the right-side front rack mount(s). The front rack mount(s) are also interchangeable between left and right if there is requirement to have the ground terminal on the left side.

The grounding cable should have a cable area of minimum 2.5 mm2 (14 AWG). 14 AWG grounding lugs is included together with the rack mounting kit. The nut size of the grounding terminal is M5 and is also included in the rack mounting kit along with an external toothed locking washer which should be placed between the lug and the nut.



Attach the grounding cable from the grounding terminal to an appropriate grounding point at your site.

Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor.

4 Startup guide

4.1 Package Contents

The DCP-R package includes the following items:

- 2x Power cord (Model depends on country/region. For AC 1,8m/6 ft. For DC 3m or 5m.)
- 2 x Ethernet patch cords
- RJ45 to DB9 adapter
- Rack-mount kit (Refer to 3.2.1 for contents)
- DCP-R chassis, incl. PSU:s and fan unit
- Quick Installation Guide

4.2 Initial start up

Connect power to the power supplies that are preinstalled in the chassis. The chassis will automatically power up as soon as the first PSU is connected. The power LED turns green.

The fan package starts up after a few seconds.

4.3 Connection to Serial Port

Connect the Serial port of the DCP-R to a computer using the serial port or a USB/Serial port adapter. Use the following settings for the serial transaction.

Parameter	Setting
Protocol	Serial
Baud rate	115200
Data bits	8
Parity	None
Stop bits	1
Flow control	None

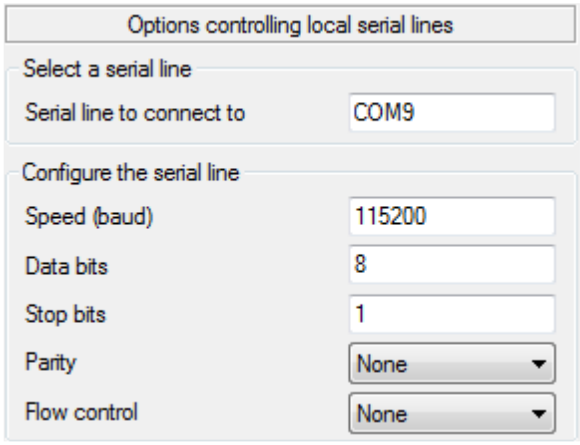


Figure 26. *COM9 is shown only as an example. Use the appropriate port ID for the connection.*

4.3.1 Serial console cable connectors

You can connect a serial RJ45 console port on the DCP units using the following diagram and table.

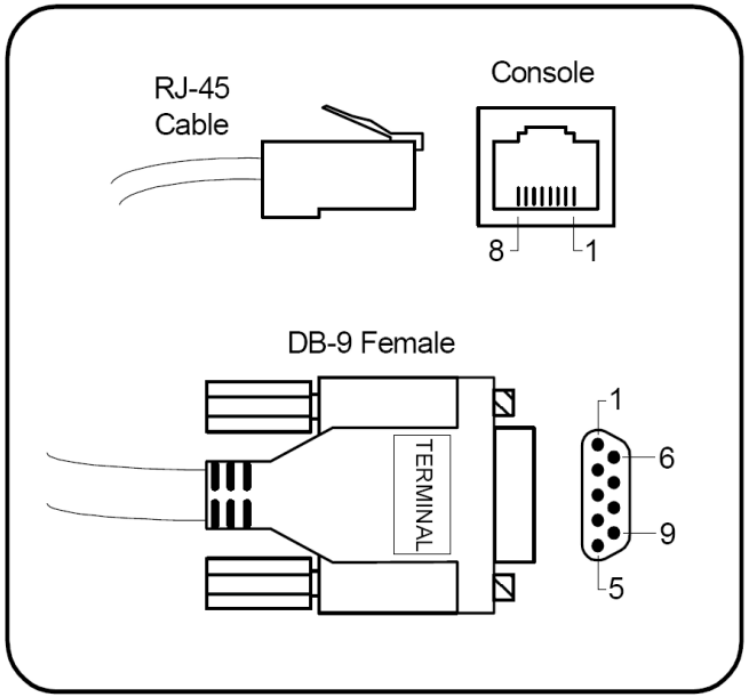


Figure 27. *Serial Console Cable Connectors*

4.3.2 Console Port Cable Pinouts

Unit Console Port (RJ45)		**Serial Port (DB9)**	
PIN	**Signal**	**PIN**	**Signal**
1	Not connected		
2	Not connected		
3	Tx Data	2	Rx Data
4	Ground	5	Ground
5	Ground	5	Ground
6	Rx Data	3	Tx Data
7	Not connected		
8	Not connected		

4.4 Installation of DCP-R node with DCP-SC-28P

When DCP-SC-28P is used as shelf controller, all ROADM configuration is done from this shelf controller. See DCP-SC-28P_User Manual for information about configuration of ROADM nodes.

4.5 Installation of DCP-R node with SO-SHELF-CTRL-XX

The DCP-R node consists of DCP-R units and a Shelf controller. The Shelf controller is installed separately.

1. Power up and install the Shelf controller, see “Shelf controller User Manual”. Use the script that is applicable as described.
2. Connect all DCP-R units to the shelf controller as described in “Shelf controller User Manual”. How the RJ45 cables are connected will decide the degree numbering in the node. Following installation steps must be done with the degree numbering in mind. If a list has been done over degree numbering as suggested in the “Shelf controller User Manual” now is the time to use it.
3. Connect via ETH0 or console port (see section 4.3) to the DCP-R that is decided to be degree/chassis 1. ETH0 has default address 192.168.0.1. For both connection types usr is admin and pw is admin.
4. Change pw for admin and note the password. Use below CLI command:
   config user chpasswd
5. Type “*config node member add <serial number>*” for all the members to be added. They should automatically appear in the list “*show node members*”. Start with adding the shelf controller then all remaining degrees in degree number order. For the controller the command should end with “controller”, i.e. “*config node member add <serial number> controller*”.

   Note that once each degree is added they will get a sequential degree number that cannot be changed later without breaking the traffic.
6. Configure hostname on each of the members.
   config chassis [degree No] *hostname*
7. Configure internal topology to setup the XC connections. Use CLI command:
   config node topology internal [fill in the ports that are connected between the degrees]
   This is not needed in managedCLI mode. If the shuffle box (H-SB-XC-6MPO) is used see section 4.11 for details.
8. After the topology is complete use CLI command:
   config node topology apply
   To store the topology database correctly.
9. Configure NodeID, Geolocation, Netconf password (user is admin). Use below CLI commands:

config node info
config node geolocation
config user netconf chpasswd
The Node ID of each node will be used later in the SoSmart node mounting sequence. It is important to note the Node ID of each node.
Min number of characters for node ID is 7.
Max number of characters for node ID is 20.

10. Configure individual internal IP address on each degree, see section 4.8. It is very important that the IP addresses set are the proposed ones in this section.
11. Configure NTP server address to 172.16.0.1 (shelf controller address). Also set admin status to up on the NTP.
12. Configure time zone. (config timezone <time zone>)
13. Configure DNS, SNMP trap destination and community.
14. Backup and upload configuration. See “DCP-CLI User Manual” for information how to do that.
15. Done. If SoSmart software suite is used it is now possible to add the node in the Manager.

4.6 Installation of ILA node with DCP-SC-28P

When DCP-SC-28P is used as shelf controller, all ILA configuration is done from this shelf controller. See DCP-SC-28P_User Manual for information about configuration of ILA nodes.

4.7 Installation of ILA node with SO-SHELF-CTRL-XX

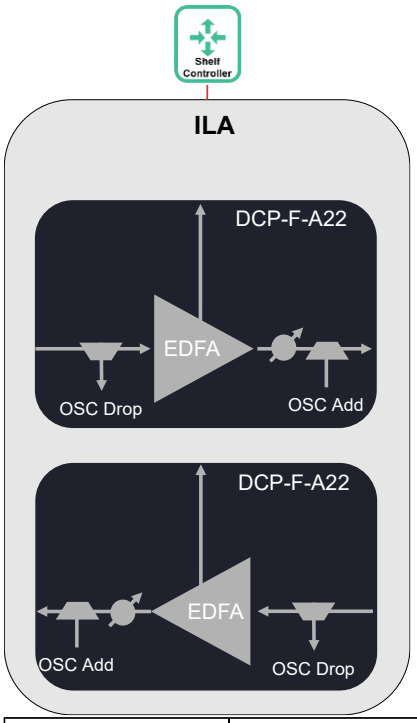
The ILA node used together with DCP-R ROADMs consists of one DCP-2 unit with 2 DCP-F-A22 cards and a Shelf controller. The Shelf controller is installed separately.

4.7.1 HW configuration of ILA node

It is important that ILAs that should be used together with ROADMs in SoSmart have the correct HW configuration. This means both the optical components as well as the internal topology for the patch cord connections.

4.7.1.1 HW components in ILA node

The complete set of components in an ILA node used together with ROADMs should include DCP-2 chassis, shelf controller, DCP-F-A22 amplifiers, VOA-SFP, OSC filter and OSC SFP.



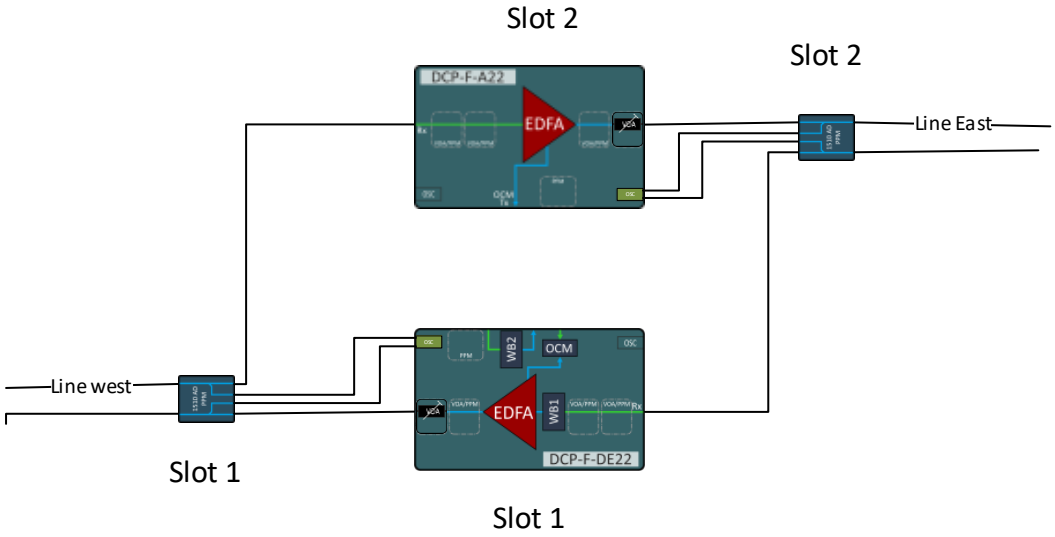
Part #	Description	Qty
DCP-2-FB/HW	Base HW, 1 RU chassis, 19", 2-traffic slots, dual power, fan units, mgmt-board	1
DCP-F-A22	EDFA amplifier with 22 dB Gain, 1RU plug-in unit, with support for 2 x Passive Plugin Modules (PPM's)	2
SO-SFP-VOA-01	SFP VOA, 0-20dB, Dark@power loss, No monitoring, LC	2
PPM-AD1-1510-2F	Passive Plug-in Module (PPM) OSC add/drop filter 1510nm	2
SO-SFP-155M-L80D-C51	SFP, STM-1/OC3, 100M Ethernet, CWDM, 80km, 29dB, LC, 1510nm	2
SO-SHELF-CTRL-AC	Shelf controller, 16x1G+2x10G, 4GB RAM, 128MB, AC	1

The OSC transceivers can be of different types, but they have to use 1510nm and they should match the OSC transceivers in the neighbour nodes.
For the DCP-2 chassis it is possible to use AC or DC power modules.
It is also possible to select shelf controllers with AC or DC power.

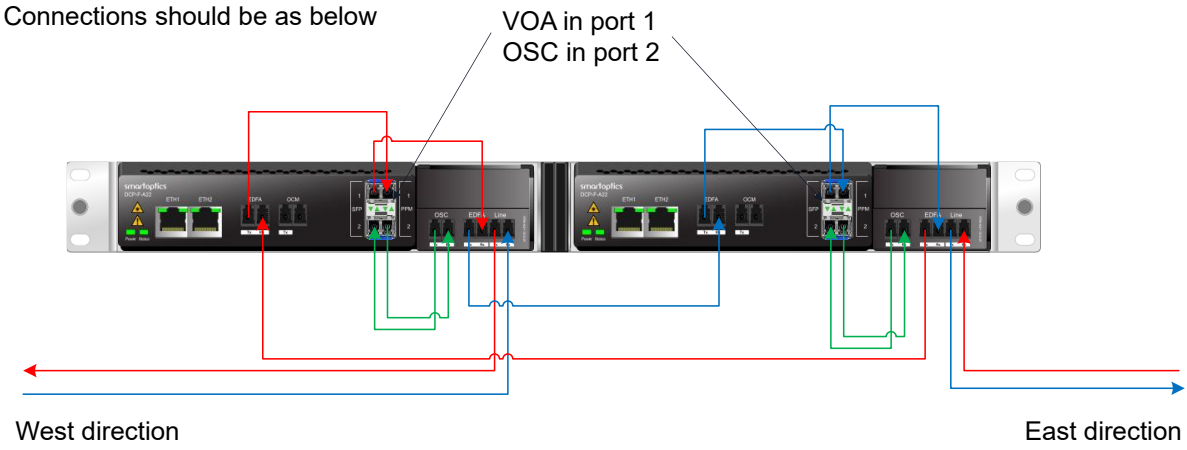
4.7.1.2 Internal topology in ILA node

The internal topology is important since SoSmart will assume that the internal components are connected in a certain way.

The picture below shows how the components are connected on functional level.



The picture below shows how the patch cords are connected on the chassis level.



4.7.2 SW configuration of ILA node

1. Power up and install the Shelf controller, see “Shelf controller User Manual”. Use the script that is applicable as described.
2. Power up DCP-2 chassis without connection between SC and DCP-2.
3. Login console or local port and set ip: 172.16.0.2. config network mgmt ipv4address 172.16.0.2 255.255.255.0 172.16.0.1
4. configure managedILA:
   admin@hostname>config automationMode managedILA
   This will change automation mode to 'managedILA'.

   Changing automation mode shuts down all CLI sessions.

   Are you sure you want to continue? (Yes/NO): y
   Automation mode set to 'managedILA'.

5. Connect ethernet cables between SC and DCP-2.
6. Login again (you should be able to use ssh to port 122 after you had set the IP address.)
7. Add SC:
   admin@hostname>config node member add HD4081YHPZQ controller
   Adding.....
   Node member HD4081YHPZQ added as controller.
8. Do show node member and check that shelf controller has become master. This might take some time and therefore you might have to write the command more than once....
9. Last step is to configure adminStatus on the amplifiers.
   config slot 1 interface edfa1 adminStatus up
   config slot 2 interface edfa1 adminStatus up

4.8 IP setup for DCP-R with SO-SHELF-CTRL-XX

It is required to set an internal IPv4 address on all the DCP-R chassis if SO-SHELF-CTRL-XX is used. This is not needed for solutions with DCP-SC-28P.

Internal IP for DCP-R in solutions with SO-SHELF-CRRL-XX is used for internal communication and NTP.

The IP setup for each degree should be as follows:

IPv4 adress: 172.16.0.**[degree no + 1]**

Netmask: 255.255.255.0

Gateway: 172.16.0.1 (This is the internal IP-address of the shelf controller)

Use ***'config chassis [degree no] network mgmt ipv4address <IP address> <Netmask> [Gateway]'*** query to set the IP address of each degree.

For example:

```
root@hostname>config chassis 2 network mgmt ipv4address 172.16.0.3 255.255.255.0
172.16.0.1

Re-configuring interface network parameters may result in lost connections.

Are you sure you want to continue? (Yes/NO): y

IP address for interface mgmt set to 172.16.0.3, subnet mask 255.255.255.0, default
gateway 172.16.0.1.
```

Note that the chassis 2 (=degree 2) in this example renders in IP address 172.16.0.3.

```
admin@smartoptics-dcp>show network interfaces

Mgmt:            if-1/eth1, if-1/eth3, if-1/eth4, if-1/eth5
IP Address:      172.16.0.3
Netmask:         255.255.255.0
Default gateway: 172.16.0.1
MAC address:     94:DE:0E:02:05:93

eth0 / local:
IP Address:      192.168.0.1
Netmask:         255.255.255.0
MAC address:     94:DE:0E:02:05:92

DNS primary:     10.10.134.254
DNS secondary:

admin@smartoptics-dcp>
```

Note: ETH0 uses the fixed IP address 192.168.0.1.

4.8.1 Use CLI interface

After a successful login, some system information is displayed on the screen.

Press the "***?***" key to see an overview of the available commands.

```
bye         - Logout from shell.
clear       - Clear parameter.
config      - Configure system information.
exit        - Logout from shell.
logout      - Logout from shell.
ping        - Send echo messages.
quit        - Logout from shell.
reboot      - Reboot of the system.
show        - Show system information.
swupgrade   - Software image management.
techlog     - upload log for technicians.
traceroute  - Trace route to destination.
```

It is always possible to use "***?***" in order to display more information.

Use the ***tab*** key for command completion.

See separate CLI manual for more details about the CLI.

4.9 User accounts

The DCP-R is shipped with 1 default user account, admin/admin.

The admin user cannot be deleted and will always be present in a system.
For security reasons, it is recommended to change the admin password.

The admin user account can do both monitoring, configuration and user administration.
It is also possible for the admin user to enable additional user accounts:

- readonly
  This account can be used for monitoring and reading, but this user cannot configure anything.
- operator
  This account can be used both for monitoring and configurations. However, this account cannot do user administration.
- sftpuser
  This account can be enabled to handle file management via sftp. It can access folders in the node file system with files for SW upgrade, techlog and PM.

In addition to these accounts, the DCP platform got a root user account that can be used by support to debug issues with the system. By default, this account is only enabled on the console port. This account can also be fully disabled or fully enabled by the user. It is recommended that the customer makes an active decision to decide what level of access the root user should have.

Possible settings:

- disable – The root account is disabled.
- enable – The root account is open over ssh and console.

- enableConsole – The root account is only open on console port.

User	Show commands	Config commands	User administration	SFTP File transfer	SW upgrade	Encryption
readonly	Yes					
operator	Yes	Yes			Yes	
admin	Yes	Yes	Yes		Yes	
sftpuser				Yes		
cryptouser	Yes	Yes	Yes		Yes	Yes

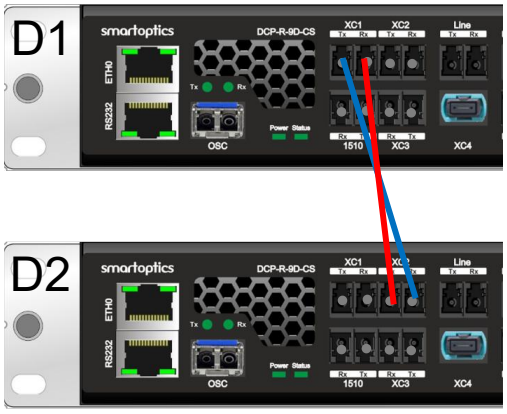
4.10 Cross connection examples for DCP-R-9D-CS

Cross connections between different degrees can be done in many different ways. It is possible to use the LC ports on XC1 to XC3 or the MPO port XC4.

This chapter shows some different examples of how this can be connected. It is not required to connect in this way, but it is recommended to keep same structure in the whole network for easier operation.

4.10.1 XC example for 2-degree node

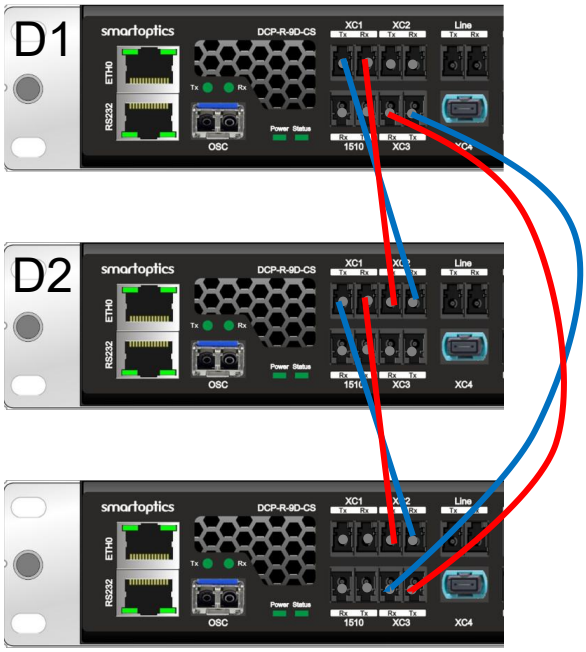
For 2-degree nodes it is easiest to use the LC ports for cross connection between the two chassis.
The example below shows one way to do it.



Tx port	Rx port
D1 XC1 Tx	D2 XC2 Rx
D2 XC2 Tx	D1 XC1 Rx

4.10.2 XC example for 3-degree node

For 3-degree nodes it is easiest to use the LC ports for cross connection between the three chassis.
The example below shows one way to do it.

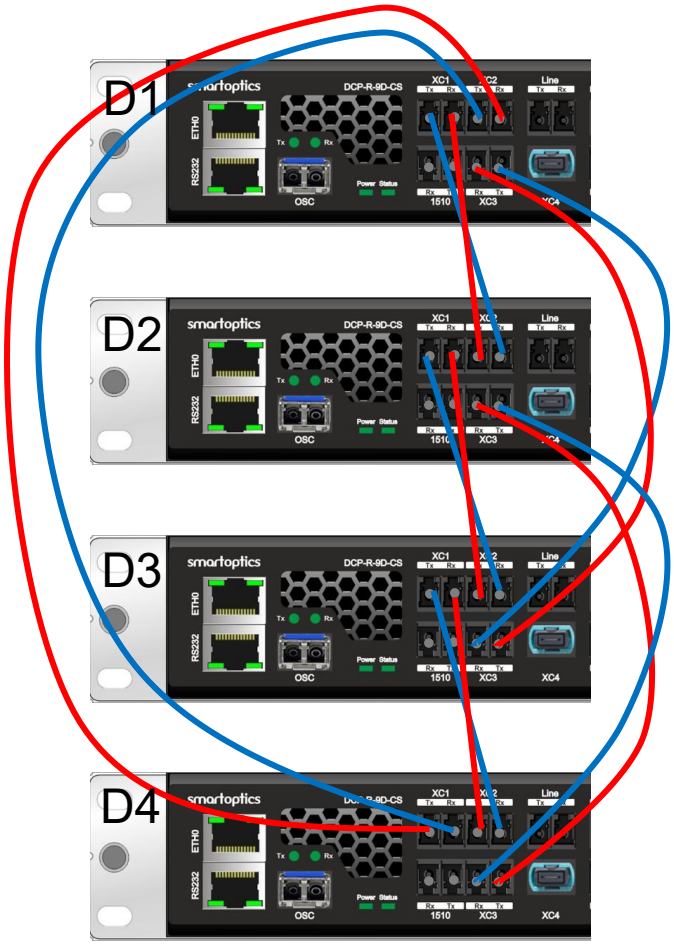


Tx port	Rx port
D1 XC1 Tx	D2 XC2 Rx
D2 XC2 Tx	D1 XC1 Rx

D2 XC1 Tx	D3 XC2 Rx
D3 XC2 Tx	D2 XC1 Rx
D1 XC3 Tx	D3 XC3 Rx
D3 XC3 Tx	D1 XC3 Rx

4.10.3 XC example for 4-degree node with LC connectors

For 4-degree nodes it is possible to use either LC ports or MPO ports for cross connection between the four chassis.
The example in this chapter shows one way to do it with LC connectors.

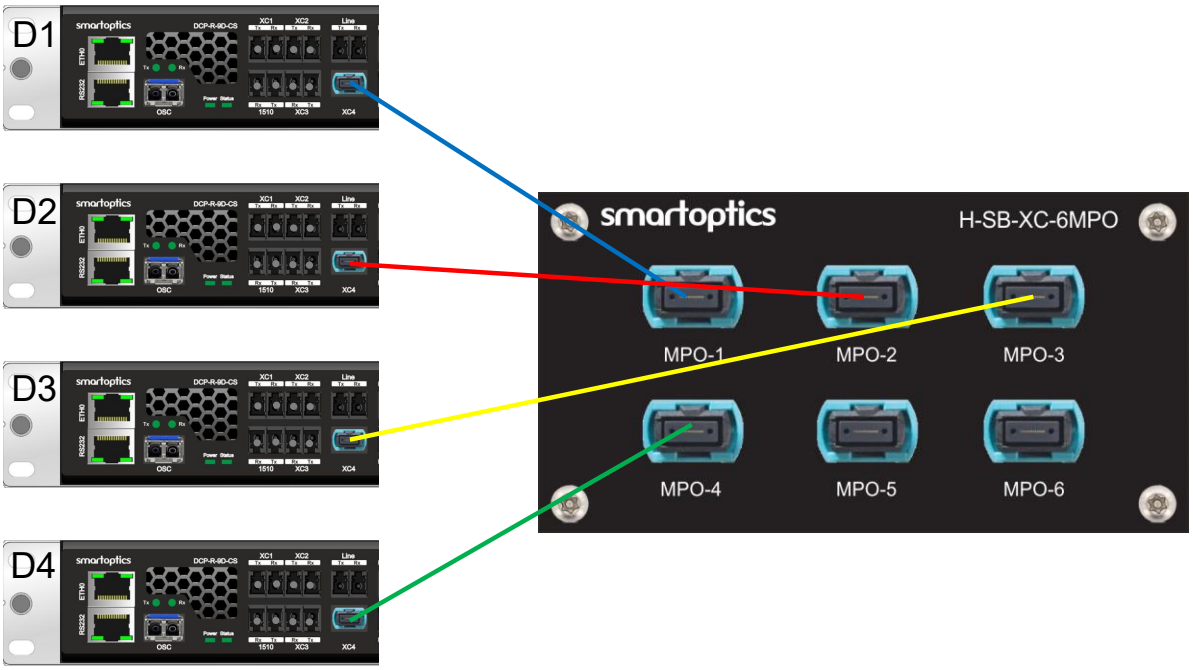


Tx port	Rx port
D1 XC1 Tx	D2 XC2 Rx
D2 XC2 Tx	D1 XC1 Rx
D2 XC1 Tx	D3 XC2 Rx

D3 XC2 Tx	D2 XC1 Rx
D1 XC3 Tx	D3 XC3 Rx
D3 XC3 Tx	D1 XC3 Rx
D3 XC1 Tx	D4 XC2 Rx
D4 XC2 Tx	D3 XC1 Rx
D4 XC1 Tx	D1 XC2 Rx
D1 XC2 Tx	D4 XC1 Rx
D2 XC3 Tx	D4 XC3 Rx
D4 XC3 Tx	D2 XC3 Rx

4.10.4 XC example for 4-degree node with shuffle box

For 4-degree nodes it is possible to use either LC ports or MPO ports for cross connection between the four chassis.
The example in this chapter shows one way to do it with a shuffle box.

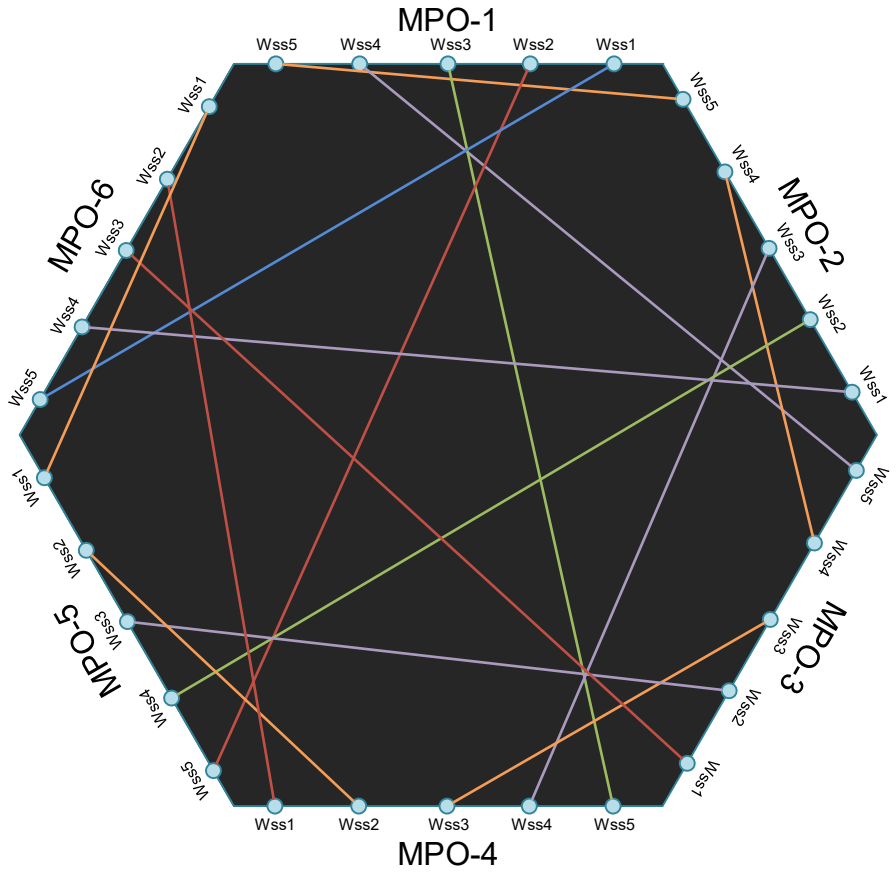


DCP-R port	Shuffle box port
D1 XC4	SB MPO1
D2 XC4	SB MPO2

D3 XC4	SB MPO3
D4 XC4	SB MPO4

4.11 Shuffle box H-SB-XC-6MPO

The shuffle box is used for connecting the MPO port of each DCP-R as previously described. The cable between each DCP-R and shuffle box should be a MPO-12 cable of type B.



For the logical connections of the shuffle box used in the internal topology definition, see table below.

		DCPR-9D D1	DCPR-9D D2	DCPR-9D D3	DCPR-9D D4	DCPR-9D D5	DCPR-9D D6
		MPO-1	MPO-2	MPO-3	MPO-4	MPO-5	MPO-6
DCPR-9D D1	MPO-1	--	XC4Wss5 <> **XC4Wss5**	XC4Wss4 <> **XC4Wss5**	XC4Wss3 <> **XC4Wss5**	XC4Wss2 <> **XC4Wss5**	XC4Wss1 <> **XC4Wss5**
DCPR-9D D2	MPO-2	XC4Wss5 <> **XC4Wss5**	--	XC4Wss4 <> **XC4Wss4**	XC4Wss3 <> **XC4Wss4**	XC4Wss2 <> **XC4Wss4**	XC4Wss1 <> **XC4Wss4**
DCPR-9D D3	MPO-3	XC4Wss5 <> **XC4Wss4**	XC4Wss4 <> **XC4Wss4**	--	XC4Wss3 <> **XC4Wss3**	XC4Wss2 <> **XC4Wss3**	XC4Wss1 <> **XC4Wss3**
DCPR-9D D4	MPO-4	XC4Wss5 <> **XC4Wss3**	XC4Wss4 <> **XC4Wss3**	XC4Wss3 <> **XC4Wss3**	--	XC4Wss2 <> **XC4Wss2**	XC4Wss1 <> **XC4Wss2**
DCPR-9D D5	MPO-5	XC4Wss5 <> **XC4Wss2**	XC4Wss4 <> **XC4Wss2**	XC4Wss3 <> **XC4Wss2**	XC4Wss2 <> **XC4Wss2**	--	XC4Wss1 <> **XC4Wss1**
DCPR-9D D6	MPO-6	XC4Wss5 <> **XC4Wss1**	XC4Wss4 <> **XC4Wss1**	XC4Wss3 <> **XC4Wss1**	XC4Wss2 <> **XC4Wss1**	XC4Wss1 <> **XC4Wss1**	--

Table 1. Shuffle box logic.

How to read the table:

Example connecting MPO-1 with MPO-3 will use from MPO-1 lanes XC4Wss4 and from MPO-3 lanes XC4Wss5

Example connecting MPO-3 with MPO-5 will use from MPO-3 lanes XC4Wss2 and from MPO-5 lanes XC4Wss3

Example connecting MPO-2 with MPO-6 will use from MPO-2 lanes XC4Wss1 and from MPO-6 lanes XC4Wss4

The colors in the table indicate which XC4Wss are used in different directions.

4.12 Breakout box H-BO-1xMPO-10xLC

The breakout box is used to break out the fibers in from the MPO port into LC ports. This can be used to connect colorless signals or to connect to different degrees. For ROADM nodes with 9 degrees is it recommended to use breakout boxes for the last three degrees.

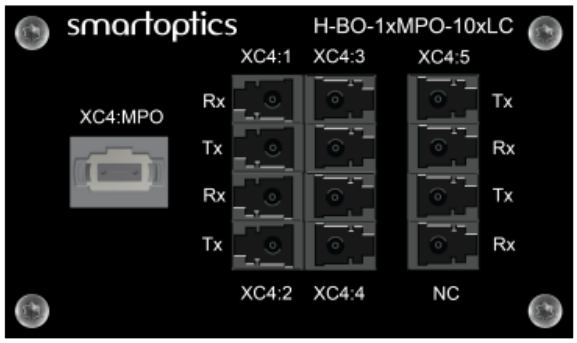


Figure 28. *Front view of a breakout box.*

5 Commissioning in managedCLI mode

The commissioning of amplifiers, VOAs, OCMs and WSS ports in managedCLI mode will be done with CLI commands. In managedNetconf mode these settings will be done by the SoSmart management system via Netconf.

5.1 Commissioning of line VOA in ROADM

In order to configure the line VOA in a ROADM it is necessary to know the link loss to the next node. It is also necessary to calculate the target output power.

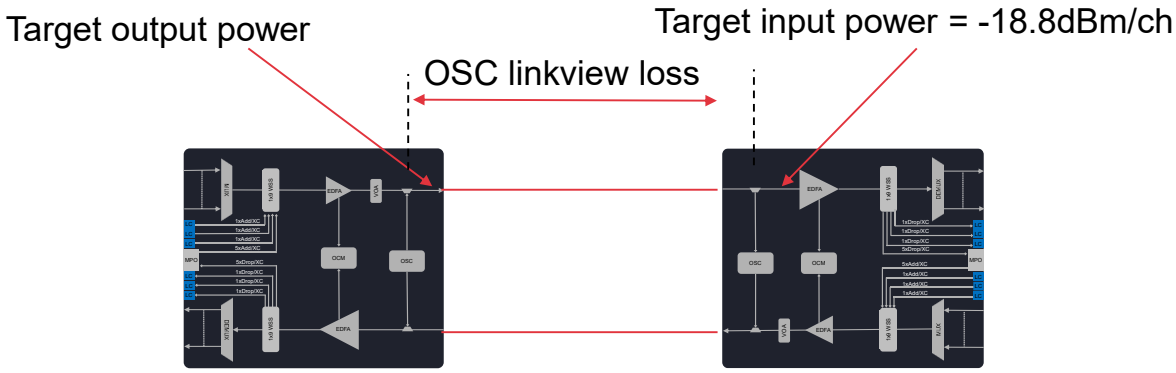
For an initial installation the link loss can be obtained by running the command:
show osclinkview

For an installation with multiple channels already installed it is possible to use linkview to get a more accurate measurement of the link loss.

The next step is to calculate the targetOutputPower. This is done with the formula:
Target output power (dBm) = Remote system target input power (dBm) + Link loss (dB)

The remote system target input power will depend on the amplifier and channel power required in the remote node.
For DCP-R-9D-CS ROADMs and ILAs with DCP-F-A22 amplifiers the target input power is -18.8dBm.
For DCP-R-34D-CS ROADMs and ILAs with DCP-F-VG amplifiers the target input power is -11.8dBm.

Example for DCP-R-9D-CS.
Target output power (dBm) = Link loss (dB) -18.8



Configure the target output power with the command: (xxx is the calculate target output power)
config interface if-1/line targetOutputPower xxx

5.2 Commissioning of line VOA in ILA with

shelf controller

In order to configure the line VOA in an ILA with shelf controller it is necessary to know the link loss to the neighbor nodes. It is also necessary to calculate the gain and VOA setting.

For an initial installation the link loss can be obtained by running the command:
show osclinkview

For an installation with multiple channels already installed it is possible to use linkview to get a more accurate measurement of the link loss.

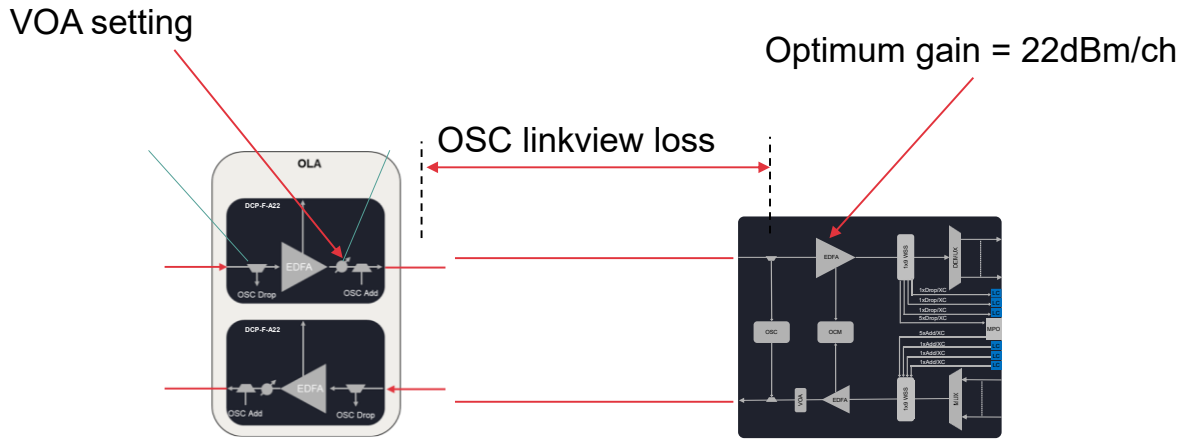
The first step is to calculate the gain of the amplifier.

5.2.1 VOA and EDFA calculation for ILA with DCP-F-A22

If the link loss from the previous node is lower or equal to 19.7dB then the gain of the DCP-F-A22 amplifier can be set to the optimum value of 22dB. If the link loss from the previous node is higher than 19.7dB it is recommended to increase the gain of the amplifier. In this case the following formula should be used:
Wanted gain (dB) = link loss (dB) -19.7 (dB)
Note that maximum setting for the gain in DCP-F-A22 is 28dB.
The gain is configured with the command: (y is the slot of the amplifier, xxx is the wanted gain)
config slot y interface edfa1 gain xxx

The next step is to calculate the VOA setting. This is done with the formula:
VOA setting (dB) = Gain of next amplifier - Link loss (dB) - VOA insertion loss
The gain of the next amplifier is 22dB if it is a DCP-R-9D-CS or 15dB if it is a DCP-R-34D-CS.

Example with DCP-R-9D-CS as next node after the ILA.



The insertion loss of a VOA SFP is typically 1.5dB.
Note that the VOA setting cannot be below 0dB or above 20dB.
The VOA is configured with the command: (xxx is the calculated VOA setting)
config slot 1 interface 1 attenuation xxx

5.2.2 VOA and EDFA calculation for ILA with DCP-F-VG

If the link loss from the previous node is lower or equal to 12.7dB then the gain of the DCP-F-VG amplifier can be set to the optimum value of 15dB. If the link loss from the previous node is higher than 12.7dB it is recommended to increase the gain of the amplifier. In this case the following formula should be used:
Wanted gain (dB) = link loss (dB) -12.7 (dB)
Note that maximum setting for the gain in DCP-F-VG is 30dB.
The gain is configured with the command: (y is the slot of the amplifier, xxx is the wanted gain)
config slot y interface edfa1 gain xxx

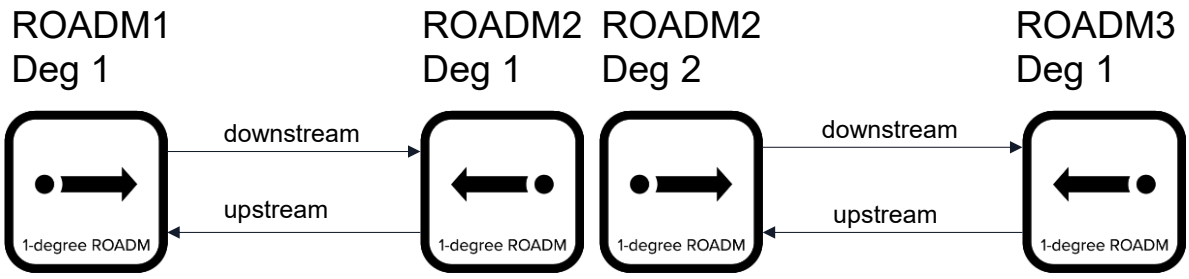
The next step is to calculate the VOA setting. This is done with the formula:
VOA setting (dB) = Gain of next amplifier - Link loss (dB) - VOA insertion loss
The gain of the next amplifier is 22dB if it is a DCP-R-9D-CS or 15dB if it is a DCP-R-34D-CS.

The insertion loss of a VOA SFP is typically 1.5dB.
Note that the VOA setting cannot be below 0dB or above 20dB.
The VOA is configured with the command: (xxx is the calculated VOA setting)
config slot 1 interface 1 attenuation xxx

5.3 Provisioning of a wavelength in managedCLI mode

It is possible to provision wavelengths from end to end in managedCLI mode. In this case it is necessary to log in to all nodes in the route. For each node and wavelength, the cross connection on the WSS should be configured and the control loop should be started.
Note that the commissioning of the line VOA should be done first so that the parameter “target output power” is configured.

Here is a step-by-step instruction for provisioning a wavelength. In this example 3 ROADM nodes are included.



Provisioning has to be done in both directions (here called downstream, and upstream), but it is recommended to complete one direction at a time in managedCLI mode.
In the example below we will start in ROADM1 and do the provisioning in the downstream direction first.

1. Set cross connection in first node (here ROADM1, deg1)
   Select localAD if the channel should start on the integrated 40ch filter. Select XC1 if the channel should start on XC port 1.
   Example for channel 9420:
   config interface if-1/9420 portMode localAD

2. Start the control loop in first node (here ROADM1, deg1)
   The control loop for a specific channel is activated by changing the optical control mode to “power”.
   config interface if-1/9420 opticalControlMode power

   When the control mode is set “power” the control loop is continuous until the mode is changed. In this state the target output power will be measured by the OCM and the WSS attenuation will be updated to reach target output power. Stay in this mode until the target output power has been reached. There is no notification about this so the user has to monitor the updated power levels with the ***show interface*** command. It could take 30-60s for the channel to reach wanted target output power.

   When the control loop has reached the target output power it is time to change the optical control mode to “gainLoss”. This means that the WSS will keep its WSS attenuation until the optical control mode is changed to “power” next time.
   config interface if-1/9420 opticalControlMode gainLoss

   Note that it is not recommended to keep the optical control loop in “power” mode for several control loops at the same time in network. This could cause instability.

3. Configure cross connections for express channel in second ROADM
   Cross connections are needed for both degrees. Check the topology so that the correct XC ports are configures.
   Example for degree 1:
   config interface if-1/9420 portMode XC1
   Example for degree 2:
   config interface if-2/9420 portMode XC1

4. Start the control loop in second node in downstream direction (here ROADM2, deg2)
   config interface if-2/9420 opticalControlMode power

   Wait until the control loop has reached the target output power and then change to “gainLoss” mode.
   config interface if-2/9420 opticalControlMode gainLoss

   Continue to next express node and repeat step 3 and 4 for the express channel. Go to step 5 when the last node should be configured.

5. Set cross connections in the last node (here ROADM3)
   Select localAD if the channel should start on the integrated 40ch filter. Select XC1 if the channel should start on XC port 1.
   Example for channel 9420:
   config interface if-1/9420 portMode localAD

6. Continue with provisioning in upstream direction
   Start in first node in upstream direction (here ROADM3).
   Repeat step 1 to 5 for the channel.

It is not necessary to do any configuration in the ILA nodes during provisioning. They should have been commissioned before the provisioning start.

6 Software upgrade/downgrade

The SW can be upgraded or downgraded with swupgrade commands in CLI. See CLI User Manual for details about SW upgrade/downgrade.

6.1 Process for upgrading a ROADM or ILA with DCP-R and DCP-SC-28P

Upgrade for both DCP-R and DCP-SC-28P is done from the shelf controller. See user manual for DCP-SC-28P.

Upgrade for both ILA DCP-2 chassis and DCP-SC-28P is done from the shelf controller. See user manual for DCP-SC-28P.

6.2 Process for upgrading a ROADM or ILA with DCP-R and SO-SHELF-CTRL-XX

1. Upgrade the DCP-R first
   This is done in three steps. See CLI manual for more details.
   a. Download SW to ROADM degree 1
      Use the “swupgrade download …” command.
      It is enough to login to degree 1 and do the upgrade commands from there.

      It is also possible to use sftpuser to transfer the file to the /swupgrade/ folder on the ROADM degree 1, but then it is also necessary to do an internal download as well.
      Example:
      swupgrade download file:/swupgrade/dcp-release-8.1.1.tar
   b. Install the SW
      Use the “swupgrade set boot …” command.
      All degrees will get the SW when “swupgrade set boot …” command is executed from degree 1.
   c. Reboot
      Using the “reboot” command from degree 1 will reboot all other degrees at same time.
2. Upgrade the shelf controller after the DCP-R
   This is done in five steps. See shelf controller user manual for more details.
   Make sure that the DCP-R units have completed the reboot before upgrading the shelf controller.

a. Download the SW to the shelf controller
   This can be done with curl commands or with ftp programs.
b. Stop the current container
c. Remove the current container
d. Add the new container
e. Start the new container

3. Login to the DCP-R degree 1 to check if all node members are included
   Use command “show node members”. It might take up to a minute before all members are synched up and shown in the node member list.

Same process is also used for upgrade of an ILA with shelf controller.

7 SNMP

7.1 General

Simple Network Management Protocol (SNMP) is a protocol used for managing and monitoring network devices.

The DCP-R supports SNMP version 1, 2c and 3. In SNMP version 1 and 2c user authentication is accomplished using community strings.

The default community string for the DCP-R is ‘public’.

For security reasons, it is recommended to change the default community string.

The SNMP Interface supports:

a. SNMPv1 for Traps.

b. SNMPv2c for Traps and for Get operations.

c. SNMPv3 for Get operations.

SNMP Set is not supported.

7.2 SNMPv3 authentication and privacy

For SNMPv3 it is possible to configure multiple users. For each user it is possible to select authentication and privacy options. A wizard with several questions will be started when a new SNMPv3 user is added. Three options for authentication and privacy can be selected:

- noAuthNoPriv = No authentication or privacy will be configured
- authNoPriv = Authentication will be configured, but not privacy
- authPriv = Both authentication and privacy will be configured

```
admin@slotB>config snmp v3 user add

Adding SNMPv3 user.

Username: snmpTest1

Method (noAuthNoPriv, authNoPriv or authPriv): authPriv
Privacy protocol (DES or AES): AES
Privacy passphrase:
Error: Privacy passphrase must be between 12 and 32 characters long.
Privacy passphrase:

Authentication protocol (SHA or MD5): MD5
Authentication passphrase:
Confirm authentication passphrase:

SNMPv3 user 'snmpTest1' added.
```

The SNMPv3 users will only be activated if the SNMPv3 is enabled.

7.3 SNMP MIBS

Smartoptics provides a range of MIBs that can be used to monitor the DCP-R system. These include interface monitoring, port states including optical parameters such as Tx/Rx power levels.

For more specific details of the available SNMP MIBs, please refer to the manual ‘DCP MIB description‘.

7.4 SNMP Traps

Traps or notifications are messages that alert of events occurring in the DCP-R.

Trap	Description
coldStart	A coldStart trap signifies that the SNMP agent has been restarted.
dcpAlarmNotificationCleared	Sent when alarms are deactivated.
dcpAlarmNotificationCritical	Sent when an alarm of severity critical is activated
dcpAlarmNotificationMajor	Sent when an alarm of severity major is activated
dcpAlarmNotificationMinor	Sent when an alarm of severity minor is activated
dcpAlarmNotificationWarning	Sent when an alarm of severity warning is activated

8 User Access and Authentication

The DCP-R supports local authentication and Terminal Access Controller Access Control System Plus (TACACS+) to control access to the units.

8.1 Local authentication

The local authentication method is always enabled. The authentication is performed against a local database stored in the unit. The default user admin is a local user with default password admin. The admin user can’t be removed from the node. Local authentication requires manual updates of usernames and passwords of each unit in the network.

For security reason, it is recommended to change the admin password.

Three user levels are possible: admin, operator and readonly. The admin user exists from start while the other two have to be enabled in CLI by the admin user.

8.2 RADIUS

RADIUS for DCP is implemented according to IETF RFC 2865 and RFC 2866.

The RADIUS remote authentication method is optional and can be enabled/disabled by the administrator. When enabled it establishes a TCP connection with a configured RADIUS server. When the user enters the username, the DCP unit communicates with the RADIUS server and verifies and confirms user credentials against a centralized database stored on the remote RADIUS server.

Note that you always login to chassis 1 when you are talking to a ROADM node. A ROADM node can consist of several DCP-R chassis in a cluster. Changing the password for chassis 1 will change the password for all chassis in the cluster. However, when RADIUS is enabled the RADIUS password will be required to login to the node, i.e. chassis 1. RADIUS is not used for direct login to other chassis.

8.2.1 Parameters used by RADIUS authentication.

Parameter	Description
adminStatus	**up**: Specifies if the RADIUS authentication is enabled **down**: Specifies if the RADIUS authentication is disabled
Timeout	Length of time that the DCP waits to receive a response from a RADIUS server. By default, the DCP waits 3 seconds. It´s possible to configure this value in the range from 0 through 90 seconds.
Retry	Number of times that the unit should try to verify the user's credentials. By default, the value is 1. It´s possible to configure this value in the range from 0 to 5.
primaryServer address	IPaddress or DNS name of the primary RADIUS server.
primaryServer port	RADIUS server port number. Valid values are between 0 and 65535. The default value is 1812.
primaryServer key	Specifies an authentication and encryption key of the primary RADIUS server. The key used by the local unit must match that used by the primary RADIUS server. The length of the key is restricted to 63 characters and can include any printable ASCII characters (If the password includes spaces, enclose the password in quotation marks).
secondaryServer address	IPaddress or DNS name of the secondary RADIUS server.
secondaryServer port	RADIUS server port number. Valid values are between 0 and 65535. The default value is 1812.
secondaryServer key	Specifies an authentication and encryption key of the secondary RADIUS server. The key used by the local unit must match that used by the secondary RADIUS server. The length of the key is restricted to 63 characters and can include any printable ASCII characters (If the password includes spaces, enclose the password in quotation marks).

8.2.2 Configuring RADIUS Authentication

These commands are used to configure the RADIUS settings. The system will only authenticate with the RADIUS server when RADIUS is configured to admin status up.

```
admin@dcpf-189>config aaa radius

adminStatus      - Configure RADIUS admin status.
primaryServer    - Configure RADIUS primary server.
retry            - Configure RADIUS server connection retry attempts.
secondaryServer  - Configure RADIUS secondary server.
timeout          - Configure RADIUS server connection timeout.

admin@dcpf-189>config aaa radius
```

8.2.2.1 Configuring RADIUS Server address

This command is used to configure the RADIUS server's addresses.

```
admin@dcpf-189>config aaa radius primaryServer address 10.10.134.33
Primary RADIUS server address set to '10.10.134.33'.

admin@dcpf-189>config aaa radius secondaryServer address 10.10.134.34
Secondary RADIUS server address set to '10.10.134.34'.
```

8.2.2.2 Configuring RADIUS Key

This command is used to configure the RADIUS server's key.

```
admin@dcpf-189>config aaa radius primaryServer key dcpRADIUSkey
Primary RADIUS server key set to 'dcpRADIUSkey'.

admin@dcpf-189>config aaa radius secondaryServer key dcpRADIUSkey2
Secondary RADIUS server key set to 'dcpRADIUSkey2'.
```

8.2.2.3 Configuring RADIUS Adminstatus

This command is used to enable/disable RADIUS authentication

```
admin@dcpf-189>config aaa radius adminStatus up
RADIUS admin status set to up.
admin@dcpf-189>
```

8.2.3 Show RADIUS status

To display the status for the RADIUS configuration, use the following command:

```
admin@dcpf-189>show aaa radius status


RADIUS admin status     : up
                                                        Timeout
  Server     Address       Port  Key            Retry  [seconds]
  ---------  ------------  ----  -------------  -----  ---------
  Primary    10.10.134.33  1812  dcpRADIUSkey   1      3
  Secondary  10.10.134.33  1812  dcpRADIUSkey2  1      3


admin@dcpf-189>
```

8.2.4 Change a RADIUS user's password

To change the RADIUS user password, use the following command:

```
dcp_cli> config user chpasswd
```

The system will prompt the user to ask for old password and new password after the user executes the command.

8.2.5 How to specify user roles in RADIUS

There are three user levels available in the DCP platform: admin, operator and readonly. It is possible to map RADIUS users to any of these groups.

Use the following settings on the RADIUS server to map users to specific groups.

In Vendor-Specific attribute (Type = 26), set Vendor-Id to 30826 (IANA Enterprise Number for Smartoptics), Vendor type to 1, and the Attribute-Specific string to one of admin, operator, readonly.

Here is an example configuration for FreeRADIUS:

- In file: /etc/freeradius/3.0/dictionary add the following line
  $INCLUDE dictionary.smartoptics
- Create also the file /etc/freeradius/3.0/dictionary.smartoptics with the content:
  VENDOR Smartoptics 30826
  BEGIN-VENDOR Smartoptics
  ATTRIBUTE Smartoptics-Userrole 1 string
  END-VENDOR Smartoptics
- Users and their roles are defined in /etc/freeradius/3.0/users like usual using this syntax:
  readonly123 Cleartext-Password := "read123"
  Smartoptics-Userrole := "readonly"

  operator123 Cleartext-Password := "operator123"
  Smartoptics-Userrole := "operator"
- If changes are made to dictionary or users you need to restart Freeradius (as root or using sudo):
  systemctl restart freeradius

8.3 TACACS+

TACACS+ for DCP is implemented according to IETF “The TACACS+ Protocol”, draft-ietf-opsawg-tacacs-18. TACACS+ protocol uses Transmission Control Protocol (TCP) as the transport protocol with destination port number 49.

https://datatracker.ietf.org/doc/draft-ietf-opsawg-tacacs/

The TACACS+ remote authentication method is optional and can be enabled/disabled by the administrator. When enabled it establishes a TCP connection with a configured TACACS+ server. When the user enters the username, the DCP unit communicates with the TACACS+ server and verifies and confirms user credentials against a centralized database stored on the remote TACACS+ server.

Note that you always login to chassis 1 when you are talking to a ROADM node. A ROADM node can consist of several DCP-R chassis in a cluster. Changing the password for chassis 1 will change the password for all chassis in the cluster. However, when TACACS+ is enabled the TACACS+ password will be required to login to the node, i.e. chassis 1. TACACS+ is not used for direct login to other chassis.

8.3.1 Parameters used by TACACS+ authentication

Parameter	Description
adminStatus	**up**: Specifies if the TACACS+ authentication is enabled **down**: Specifies if the TACACS+ authentication is disabled
Timeout	Length of time that the DCP waits to receive a response from a TACACS+ server. By default, the DCP waits 3 seconds. It´s possible to configure this value in the range from 1 through 90 seconds.
Retry	Number of times that the unit should try to verify the user's credentials. By default, the value is 1. It´s possible to configure this value in the range from 0 to 5.
primaryServer address	IPaddress or DNS name of the primary TACACS+ server.
primaryServer port	TACACS+ server port number. Valid values are between 0 and 65535. The default value is 49.
primaryServer key	Specifies an authentication and encryption key of the primary TACACS+ server. The key used by the local unit must match that used by the primary TACACS+ server. The length of the key is restricted to 63 characters and can include any printable ASCII characters (If the password includes spaces, enclose the password in quotation marks).
secondaryServer address	IPaddress or DNS name of the secondary TACACS+ server.
secondaryServer port	TACACS+ server port number. Valid values are between 0 and 65535. The default value is 49.
secondaryServer key	Specifies an authentication and encryption key of the secondary TACACS+ server. The key used by the local unit must match that used by the secondary TACACS+ server. The length of the key is restricted to 63 characters and can include any printable ASCII characters (If the password includes spaces, enclose the password in quotation marks).

8.3.2 Configuring TACACS+ Authentication

These commands are used to configure the TACACS+ settings. The system will only authenticate with the TACACS+ server when TACACS+ admin status is up.

```
dcp_cli> config aaa tacplus
adminStatus      - Configure TACACS+ admin status.
primaryServer    - Configure TACACS+ primary server.
retry            - Configure TACACS+ server connection retry attempts.
secondaryServer  - Configure TACACS+ secondary server.
timeout          - Configure TACACS+ server connection timeout.
dcp_cli>
```

8.3.2.1 Configuring TACACS+ Server address

This command is used to configure the TACACS+ server's addresses.

```
dcp_cli> config aaa tacplus primaryServer address 10.10.134.33
Primary TACACS+ server address set to '10.10.134.33'.

dcp_cli>config aaa tacplus secondaryServer address 10.10.134.34
Secondary TACACS+ server address set to '10.10.134.34'.
```

8.3.2.2 Configuring TACACS+ Key

This command is used to configure the TACACS+ server's key.

```
dcp_cli>config aaa tacplus primaryServer key sosrvtest01
Primary TACACS+ server key set to 'sosrvtest01'.

dcp_cli> config aaa tacplus secondaryServer key testing123
Secondary TACACS+ server key set to 'testing123'.
```

8.3.2.3 Configuring TACACS+ Adminstatus

This command is used to enable/disable TACACS+ authentication

```
dcp_cli> config aaa tacplus adminStatus up
TACACS+ admin status set to up.
```

8.3.3 Show TACACS+ status

To display status for a TACACS+, use the following command:

```
dcp_cli> show aaa tacplus status
TACACS+ admin status     : up
                                                    Timeout
  Server     Address       Port  Key          Retry  [seconds]
  ---------  ------------  ----  -----------  -----  ---------
  Primary    10.10.134.33  4950  sosrvtest01  1      5
  Secondary  10.10.134.34  49    testing123   1      5
dcp_cli>
```

8.3.4 Change a TACACS+ user's password

If the server is configured with "End User Authentication Settings" it is possible to change the password of the current TACACS+ user via CLI commands on the DCP.

To change the TACACS+ user password, use the following command:

```
dcp_cli> config user chpasswd
```

The system will prompt the user to ask for old password and new password after the user executes the command.

8.3.5 Troubleshooting TACACS+ server connection with NETCAT

In case the DCP unit is not able to connect with the TACACS+ server, there might be some firewall or access list blocking the traffic. Verify the connectivity to the TACACS+ server with netcat by issuing the following commands.

```
dcp_cli> nc <address> <port>
```

Attribute	Description
<address>	Specifies the IP address of the TACACS+ server.
<port>	Specifies the port number of the TACACS+ server. Valid value is between 0 and 65535. Default value is 49.

8.3.1 How to specify user roles in TACACS

There are three user levels available in the DCP platform: admin, operator and readonly. It is possible to map TACACS users to any of these groups.

Use the following settings on the TACACS server to map users to specific groups.

Set attribute userrole=<role> where <role> is one of admin, operator, readonly.
In TACACS+ servers based on https://shrubbery.net/tac_plus/ this can be done as follows:

```
user = albert {
        name = "Albert Einstein"
        login = cleartext "E=mc^2"
        member = "admin"
        service = exec {
                userrole = readonly        <-- this line sets the user role to
'readonly'
        }
}
```

9 Audit Trail

The DCP platform records events that occur within the system and provides logging mechanism for Authentication, Fault management and Accounting.

9.1 Authentication

The Access Logs enables tracking of login/logout and password changes activity of users including unsuccessful login events. The last 200 events is kept within the node and for longer history keeping of events an external Syslog should be configured. When the max allowed log entries is reached, the oldest entries are overwritten with new events.

9.1.1 show syslog access

To display access logs, use the following command:

```
dcp_cli> show syslog access
  Time                 PID   Remote host     Event
  -------------------  ----  --------------  --------------------------
  2020-06-02 08:25:42  1021  10.212.148.241  Local User admin logged in
dcp_cli>
```

9.2 Fault management

The Alarm log keeps track of all activated and deactivated alarms occurred within the system. The last 200 events is kept within the node and for longer history keeping of events an external Syslog should be configured. When the max allowed log entries is reached, the oldest entries are overwritten with new events.

9.2.1 show syslog alarm

To display alarm logs, use the following command:

```
dcp_cli>show syslog alarm
  Time                 Alarm
  -------------------  ------------------------------------------------------------------------------
  2020-05-29 06:16:13  Alarm "Power supply missing" activated on interface psu-1/2 with severity critical.
dcp_cli>
```

9.3 Accounting

The Configuration log enables tracking of all config, clear, reboot and swupgrade commands activity within the system. The last 200 events are kept within the node and for longer history keeping of events an external Syslog should be configured. When the max allowed log entries is reached, the oldest entries are overwritten with new events.

9.3.1 show syslog config

To display the configuration logs, use the following command:

```
dcp_cli>show syslog config
  Time                 User       Remote host     Event
  -------------------  ---------  --------------  --------------------
  2020-06-02 08:49:57  admin@CLI  10.212.148.241  clear alarm log
  2020-06-02 08:50:12  admin@CLI  10.212.148.241  config slot 1 reboot
dcp_cli>
```

10 Syslog

Syslog is a standard log transport mechanism that enables the aggregation of log data into a central repository for archiving, analysis, and reporting. The DCP platform can be configured to forward Access, Alarm and Configuration logs to an external syslog server. It's possible to configure the transport with TCP for reliable and secure log forwarding, or UDP for non-secure forwarding.

10.1.1 Parameters to communicate with remote syslog

Parameter	Description
Access	**Disable**: Disables sending access log to remote syslog server. **Enable:** Enables sending access log to remote syslog server.
adminStatus	**up**: Specifies if the remote syslog server is enabled **down**: Specifies if the remote syslog server is disabled
Alarm	**Disable**: Disables sending alarm log to remote syslog server. **Enable:** Enables sending alarm log to remote syslog server.
Config	**Disable**: Disables sending config log to remote syslog server. **Enable:** Enables sending config log to remote syslog server.
Port	Remote syslog server port number. Valid values are between 0 and 65535.
Protocol	**tcp:** Configure remote syslog server network protocol to tcp. **udp**: Configure remote syslog server network protocol to udp.
Primary Server	IP address or DNS name of the primary syslog server.
Secondary Server	IP address or DNS name of the secondary syslog server.

10.1.2 Configuring remote syslog

These commands are used to configure and sending system messages to a specified syslog server. The system will only send messages to the server when admin status is up.

```
dcp_cli> config syslog remote
access           - Configure sending access log to remote syslog servers.
adminStatus      - Configure remote syslog server admin status.
alarm            - Configure sending alarm log to remote syslog servers.
config           - Configure sending configuration log to remote syslog servers.
primaryServer    - Configure remote primary syslog server.
secondaryServer  - Configure remote secondary syslog server.
dcp_cli>
```

10.1.2.1 config syslog remote access enable/disable

This command is used to enable/disable sending access log system messages to remote syslog server.

```
dcp_cli>config syslog remote access enable
Enabled sending access log to remote syslog server.
admin@hostname>config syslog remote access disable
Disabled sending access log to remote syslog server.
dcp_cli>
```

10.1.2.2 config syslog remote adminStatus up/down

This command is used to enable/disable sending system messages to remote syslog server.

```
dcp_cli>config syslog remote adminStatus up
Remote syslog server admin status set to up.
dcp_cli>config syslog remote adminStatus down
Remote syslog server admin status set to down.
dcp_cli>
```

10.1.2.3 config syslog remote alarm enable/disable

This command is used to enable/disable sending alarm log system messages to remote syslog server.

```
dcp_cli>config syslog remote alarm enable
Enabled sending alarm log to remote syslog server.
dcp_cli>config syslog remote alarm disable
Disabled sending alarm log to remote syslog server.
dcp_cli>
```

10.1.2.4 config syslog remote config enable/disable

This command is used to enable/disable sending config log system messages to remote syslog server.

```
dcp_cli>config syslog remote config enable
Enabled sending configuration log to remote syslog server.
dcp_cli>config syslog remote config disable
Disabled sending configuration log to remote syslog server.
dcp_cli>
```

10.1.2.5 config syslog remote primaryServer address <address>

This command is used to configure the IP address of the primary syslog server.

```
dcp_cli> config syslog remote primaryServer address 10.10.11.22
Remote primary syslog server address set to '10.10.11.22'.
dcp_cli>
```

10.1.2.6 config syslog remote primaryServer port <port>

This command is used to configure the remote syslog port number for the primary server.

```
dcp_cli>config syslog remote primaryServer port 514
Remote primary syslog server port set to '514'.
dcp_cli>
```

10.1.2.7 config syslog remote primaryServer protocol <protocol>

This command is used to configure the remote syslog network protocol for the primary server.

```
admin@L8-109-B-D1>config syslog remote primaryServer protocol
tcp udp
admin@L8-109-B-D1>config syslog remote primaryServer protocol udp
Primary remote syslog server network protocol set to udp.
```

10.1.3 show syslog status

To display the status of the configured syslog, use the following command:

```
admin@Stockholm-97>show syslog status
Remote syslog admin status     : up
  Server     Address      Protocol  Port
  ---------  -----------  --------  ----
  Primary    10.10.11.22  udp       514
  Secondary               udp       514

  Log     Remote logging  Facility
  ------  --------------  ---------------
  Access  enabled         auth + authpriv
  Alarm   enabled         local7
  Config  enabled         local6
```

11 Adding and removing degrees from a DCP-R node

The DCP-R cards and shelf controllers that belong to a node can be seen with the command:
show node members

It is possible to add and remove node members from the node cluster. See more details in the following chapters.

11.1 Adding node members

New DCP-R units can be added to the node cluster with the command: (use tab to see available serial numbers and possible chassis numbers)

config node members add <serial number> chassis-x

Note that once each degree is added they will get a sequential degree number that cannot be changed later without breaking the traffic.
Note that the added DCP-R unit will inherit the parameter settings (including password) from the master.

- Users passwords: admin, operator, readonly, sftpuser
- TACACS/RADIUS server configurations
- Syslog
- Rootaccess
- Timezone
- AutomationMode
- Network: DNS

Adding a shelf controller is done with the command:
config node members add <serial number> controller

11.2 Removing node members

DCP-R units can be removed from the node cluster with the command:

config node members remove

Note that this command will always remove the last degree first.

Same command is also used to separate degree 1 from the shelf controller.

12 Factory default

It is possible to reset a DCP-R card to factory default settings.

If the DCP-R is separated from the shelf controller it is possible to execute the command directly. Use command “factorydefault”. The chassis will be rebooted after the command.

If the DCP-R is still connected to a node with shelf controller it is necessary to stop the container before the factory default is done on the DCP-R.

1. Stop the container in the shelf controller first and then do a factory default on the new chassis.
   The container in the shelf controller can be stopped by logging in to the shelf controller and type: /container/stop 0
   Wait 1 min for the container to stop completely.
2. The do a factory default on the DCP-R chassis.
   Use command “*factorydefault*”. The chassis will be rebooted after the command.
3. Go back to the shelf controller and start the container again after the factory default is done.
   The container in the shelf controller can be started by logging in to the shelf controller and type: /container/start 0

13 Replacement procedure

There are different replacement procedures for replacing a ROADM chassis compared to replacing the shelf controller.

13.1 Replacement of DCP-R chassis

The replacement procedure is different depending on which shelf controller that is used.

For DCP-R replacement with shelf controller SO-SHELF-CTRL-XX see manual SO-SHELF-CTRL_XX_User_Manual.

For DCP-R replacement with shelf controller DCP-SC-28P see manual DCP-SC-28P_User_Manual.

13.2 Replacement of shelf controller

See the Shelf controller User Manual for instructions how to replace a shelf controller.

13.3 Replacement of ILA node with shelf controller

See the Shelf controller User Manual for instructions how to replace an ILA with shelf controller.

14 Waste management

The HW should be treated as electronic waste when it is decommissioned and taken out of service.

15 Technical Specifications

ENVIRONMENT:	
OPERATING TEMPERATURE	0° C to 45° C
HUMIDITY	5% to 85% RHI
SUPPLY VOLTAGE	Dual feeding DCP-2-PSU-AC-FB: 100-127VAC (3A) and 200-240 VAC (1,5A) DCP-2-PSU-DC-FB: -40 to -72 VDC (7A)
POWER CONSUMPTION **DCP-R-9D-CS**	DCP-R-9D-CS chassis with fans and 2 PSU (AC) Max: 55W at steady state Typical: 47W at steady state and +25 Deg C Max: 88W during startup
POWER CONSUMPTION **DCP-R-34D-CS**	DCP-R-34D-CS chassis with fans and 2 PSU (AC) Max: 65W at steady state Typical: 45W at steady state and +25 Deg C Max: 97W during startup
REDUNDANCY	Hot swappable fan & PSUs
COOLING FANS	Front-to-Back straight through airflow
ALTITUDE	3000 m (10.000 ft.)
DIMENSIONS (DCP-R):	
HEIGHT	1.77” (1 RU) (H), 45mm (H)
WIDTH	17.3” (W), 440mm (W)
DEPTH	20” (D), 510mm (D)
WEIGHT	~ 8.1 Kg (DCP-R-9D-CS chassis without PSU) ~ 9.7 Kg (DCP-R-9D-CS chassis with PSU) ~ 7.8 Kg (DCP-R-34D-CS chassis without PSU) ~ 9.3 Kg (DCP-R-34D-CS chassis with PSU)

NETWORK MANAGEMENT:	
MANAGEMENT INTERFACES	4 x RJ45 LAN ports 10/100/1000Base-T in rear side 1 x SFP LAN port 100/1000 Base-X in rear side 1 x RS-232 serial port in front side 1 x RJ-45 local craft 10/100/1000 Base-T in front side
SOFTWARE UPGRADE	Traffic hitless – dual image

REGULATORY COMPLIANCES	
EMC	Title 47 CFR Part 15 Subpart B EN55024/CISPR24: 2011 + A1:2015 EN55032:2015/CISPR32 ETSI EN 300 386 V2.1.1
SAFETY	CB (IEC 60950-1:2005+A1+A2) ETL (CSA C22.2#62368-1:2014 Ed.2, UL 62368-1:2014 Ed.2)
NEBS	Level 3
LASER SAFETY	IEC 60825-1 : 2007 (2nd Edition) IEC 60825-1:2014 (Third Edition)
BOOT TIMING	Booting from Coldstart < 5min Warmstart reboot < 2min
PROTOCOLS	CLI, SNMP, SYSLOG, TACACS+

15.1 Optical parameters for DCP-R-9D-CS

OPTICAL PARAMETERS	
DCP-R-9D-CS PRE-AMPLIFIER OPTICAL SPECIFICATION	
EDFA MAXIMUM TOTAL OUTPUT POWER	20 dBm
EDFA GAIN FLATTENED OPTIMIZED GAIN	22 dB
EDFA SETTABLE GAIN	22-28 dB
EDFA INPUT POWER RANGE	-2 to -30 dBm
EDFA NOISE FIGURE	5,5 dB
MONITOR PORT RATIO	1% (20 dB)
DCP-R-9D-CS BOOSTER-AMPLIFIER OPTICAL SPECIFICATION	

EDFA MAXIMUM TOTAL OUTPUT POWER	20 dBm
EDFA GAIN FLATTENED OPTIMIZED GAIN	22 dB
EDFA SETTABLE GAIN	22-28 dB
EDFA INPUT POWER RANGE	-2 to -30 dBm
EDFA NOISE FIGURE	5,5 dB
MONITOR PORT RATIO	1% (20 dB)
WSS OPTICAL SPECIFICATION	
WSS RESOLUTION	6,25 GHz (Flexgrid)
WSS CHANNEL WIDTH	Min: 37,5 GHz Max: 500GHz
WSS MIN CENTER FREQ	191,35 THz
WSS MAX CENTER FREQ:	196,25 THz
WSS NO CHANNELS (50 GHZ)	96 (191,35 –196,10 THz)
WSS NO CHANNELS (100 GHZ)	48 (191,4 –196,1 THz)
WSS INSERTION LOSS	Min: 2,5dB Typical: 6,3dB Max 8 dB
OCM OPTICAL SPECIFICATION	
OCM OPERATING RANGE	191.175-196.275 THz
OCM RESOLUTION	6.25 GHz (Flexgrid)
POWER RESOLUTION	0,01 dB
MIN DETECTION LEVEL PER CHANNEL	-45 dBm
ACCURACY	+/-1,5 dB
VOA	
INSERTION LOSS	1,5dB
MAX VOA SETTING	20dB
OSC FILTER	
INSERTION LOSS EXPRESS	0,4dB
INSERTION LOSS ADD/DROP	0,7dB
40CH MUX/DEMUX	
CHANNEL PLAN	192.1-196.0 THz
CHANNEL SPACING	100GHz
3DB PASSBAND WIDTH	80GHz

INSERTION LOSS	Typical: 4dB Max: 5.5dB

15.2 Optical parameters for DCP-R-34D-CS

OPTICAL PARAMETERS	
DCP-R-34D-CS PRE-AMPLIFIER OPTICAL SPECIFICATION	
EDFA MAXIMUM TOTAL OUTPUT POWER	20 dBm
EDFA GAIN FLATTENED OPTIMIZED GAIN	15-25 dB
EDFA SETTABLE GAIN	15-32 dB
EDFA INPUT POWER RANGE	+5 to -40 dBm
EDFA NOISE FIGURE	8.1dB @ Gain=15dB 6.3dB @ Gain=20dB 6.0dB @ Gain=25dB
MONITOR PORT RATIO	1% (20 dB)
DCP-R-34D-CS BOOSTER-AMPLIFIER OPTICAL SPECIFICATION	
EDFA MAXIMUM TOTAL OUTPUT POWER	20.5 dBm
EDFA GAIN FLATTENED OPTIMIZED GAIN	18-22 dB
EDFA SETTABLE GAIN	18-24 dB
EDFA INPUT POWER RANGE	+2.5 to -26 dBm
EDFA NOISE FIGURE	6.1dB @ Gain=18dB 5.2dB @ Gain=22dB 5.3dB @ Gain=24dB
MONITOR PORT RATIO	1% (20 dB)
WSS OPTICAL SPECIFICATION	
WSS RESOLUTION	6,25 GHz (Flexgrid)
WSS CHANNEL WIDTH	Min: 37,5 GHz Max: 500GHz
WSS MIN CENTER FREQ	191,35 THz
WSS MAX CENTER FREQ:	196,15 THz
WSS NO CHANNELS (50 GHZ)	96 (191,35 –196,10 THz)
WSS NO CHANNELS (100 GHZ)	48 (191,4 –196,1 THz)
WSS INSERTION LOSS	Typical: 7.5dB Max 8.5 dB

OCM OPTICAL SPECIFICATION	
OCM OPERATING RANGE	191.175-196.275 THz
OCM RESOLUTION	6.25 GHz (Flexgrid)
POWER RESOLUTION	0,01 dB
MIN DETECTION LEVEL PER CHANNEL	-45 dBm
ACCURACY	+/-1,5 dB
VOA	
INSERTION LOSS	1,5dB
MAX VOA SETTING	20dB
OSC FILTER	
INSERTION LOSS EXPRESS	0,4dB
INSERTION LOSS ADD/DROP	0,7dB

15.3 Supported OSC transceivers

CERTIFIED TRANSCEIVERS FOR OSC	
PART NUMBER	Description
SO-SFP-155M-L80D-C51	SFP STM1/OC3 FE CWDM 80km 1510nm
SO-SFP-155M-L120D-C51	SFP STM1/OC3 FE CWDM 120km 1510nm
SO-SFP-155M-L200D-C51	SFP STM1/OC3 FE CWDM 200km 1510nm
SO-SFP-155M-O-C51-E	SFP 155M OTDR C51 E-tmp
SO-SFP-1G-O-C51-E	SFP 1G OTDR C51 E-tmp
SO-SFP-L80D-C51	SFP 1GE FC CWDM 80km 1510nm
SO-SFP-L120D-C51	SFP 1GE FC CWDM 120km 1510nm
SO-SFP-L160DH-C51	SFP 1GE FC CWDM 160km HP 1510nm
SO-SFP-L160D-C51	SFP 1GE FC CWDM 160km 1510nm
SO-SFP-L50D-C51	SFP, 1G Ethernet, 1G FC, CWDM, 50km, 19dB, LC, 1510nm

Appendix A List of protocols and ports numbers used by DCP-R

The below table contains information on which services and network protocols are used in the DCP-R and their intended purpose. This information is useful if the DCP-R is installed in a secure network where firewalls might need to be configured to allow for full functionality.

Service	Port	Protocol	Description
FTP	21	TCP	Used for software upgrades.
SSH	22	TCP	Used for secure logins to the CLI.
TACACS+	49	TCP	Used for authentication, authorization and accounting (AAA) services
DNS	53	TCP & UDP	Used for mapping host names to IP-addresses.
HTTP	80	TCP	Used for software upgrades.
NTP	123	UDP	Used to synchronize the system against an NTP server.
SNMP	161	UDP	Used for SNMP management and monitoring of the system.
SNMP Trap	162	UDP	Used by SNMP to send traps to the SNMP receiver(s).
Syslog	514	TCP & UDP	Used for system logging
RADIUS	1812	UDP	Used for authentication, authorization and accounting (AAA) services

See more info in the Shelf controller user manual for SSH Master, HTTP, SNMP and Netconf ports.

Appendix B Typical power levels on add/drop ports

The typical input and output power levels on the add/drop ports for DCP-R are different for different products and for different port types. Add and drop is possible both on mux/demux ports and XC ports. There is a minimum input power that can be detected by the OCM. This depends on internal settings for the OCM and the amplifiers.

The table below shows minimum input power that can be detected on the add/drop ports for different units and ports.

Min input power to add/drop port on DCP-R

DCP-R model	Port	Mux+WSS loss (dB)	WSS setting (dB)	Booster gain (dB)	Monitor loss (dB)	Margin (dB)	Min input on OCM (dBm)	Min input to add/drop port (dBm)
DCP-R-9D-CS	Mux	10.3	15	22	20	1	-35	-10.7
DCP-R-9D-CS	XC	6.3	15	22	20	1	-35	-14.7
DCP-R-34D-CS	XC	8.5	15	19	20	1	-35	-9.5

The default WSS setting is 15dB when the system starts up. This is not settable in this release but may be settable in later releases.
Note that it is possible to change the booster gain for DCP-R-34D-CS. 19dB is the default value, but it can be changed in the range 18-22dB.

Even if the input power can be detected it is not certain that the signal power can reach optimum power level on the booster amplifier. For optimum conditions it should be the same power level on all 48ch with 100GHz spacing. For an amplifier with 20dBm total power it means 20-10*log(48)=+3.2dBm/ch. For different products and port types it is possible to calculate the min input power to reach the optimum value. If the optimum power level cannot be reached there will be a penalty on the OSNR for those signals.
The table below shows the min input power to reach optimum power level for different units and ports.

Min input power to add/drop port on DCP-R without penalty

DCP-R model	Port	Booster output power (dBm)	Booster power per channel (dBm(ch)	Booster gain (dB)	Min input to booster per channel (dBm/ch)	Mux+WSS loss (dB)	Min input to add/drop port (dBm)
DCP-R-9D-CS	Mux	20	3.2	22	-18.8	10.3	-8.5
DCP-R-9D-CS	XC	20	3.2	22	-18.8	6.3	-12.5
DCP-R-34D-CS	XC	20.5	3.7	19	-15.3	8.5	-6.8

The table below shows typical output power on the add/drop ports for different units and ports.

Typical output power from add/drop port on DCP-R

DCP-R model	Port	Pre-amp output power (dBm)	WSS setting (dB)	Mux+WSS loss (dB)	Typical output power on add/drop port (dBm)
DCP-R-9D-CS	Demux	3.2	5	10.3	-12.1
DCP-R-9D-CS	XC	3.2	5	6.3	-8.1
DCP-R-34D-CS	XC	3.2	0	8.5	-5.3

Note that the default setting on the WSS is 5dB for DCP-R-9D-CS and 0dB for DCP-R-34D-CS. This values is settable in the range 0-15dB.